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ELECTRICAL WORLD

May 10, 1930
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EARL WHITEHORNE, *Contributing Editor*
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H. M. CAMERON, *Associate Editor*
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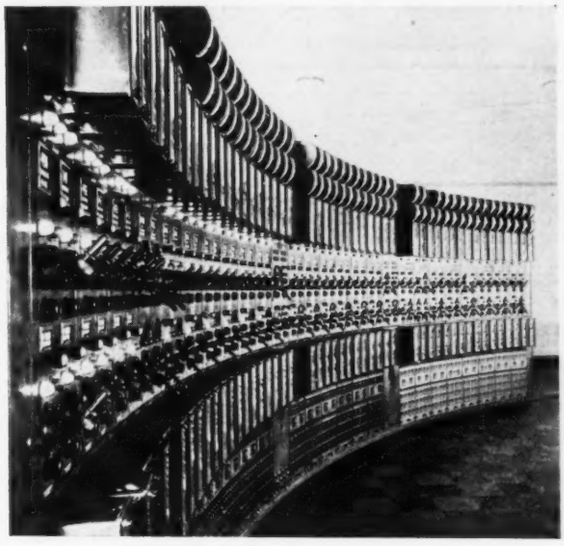
E. R. SEARLES, *Assistant Editor*

FRANK R. INNES, *Western Editor, 520 N. Michigan Ave., Chicago*
H. S. KNOWLTON, *New England Editor, 1427 Statler Bldg., Boston*
WALTER C. HESTON, *Pacific Coast Editor, 883 Mission St., San Francisco*
PAUL WOOTON, *Washington Correspondent, National Press Bldg., Washington*

JAMES H. RUDD, *Publishing Director*



Ewing Galloway

MAY 10, 1930

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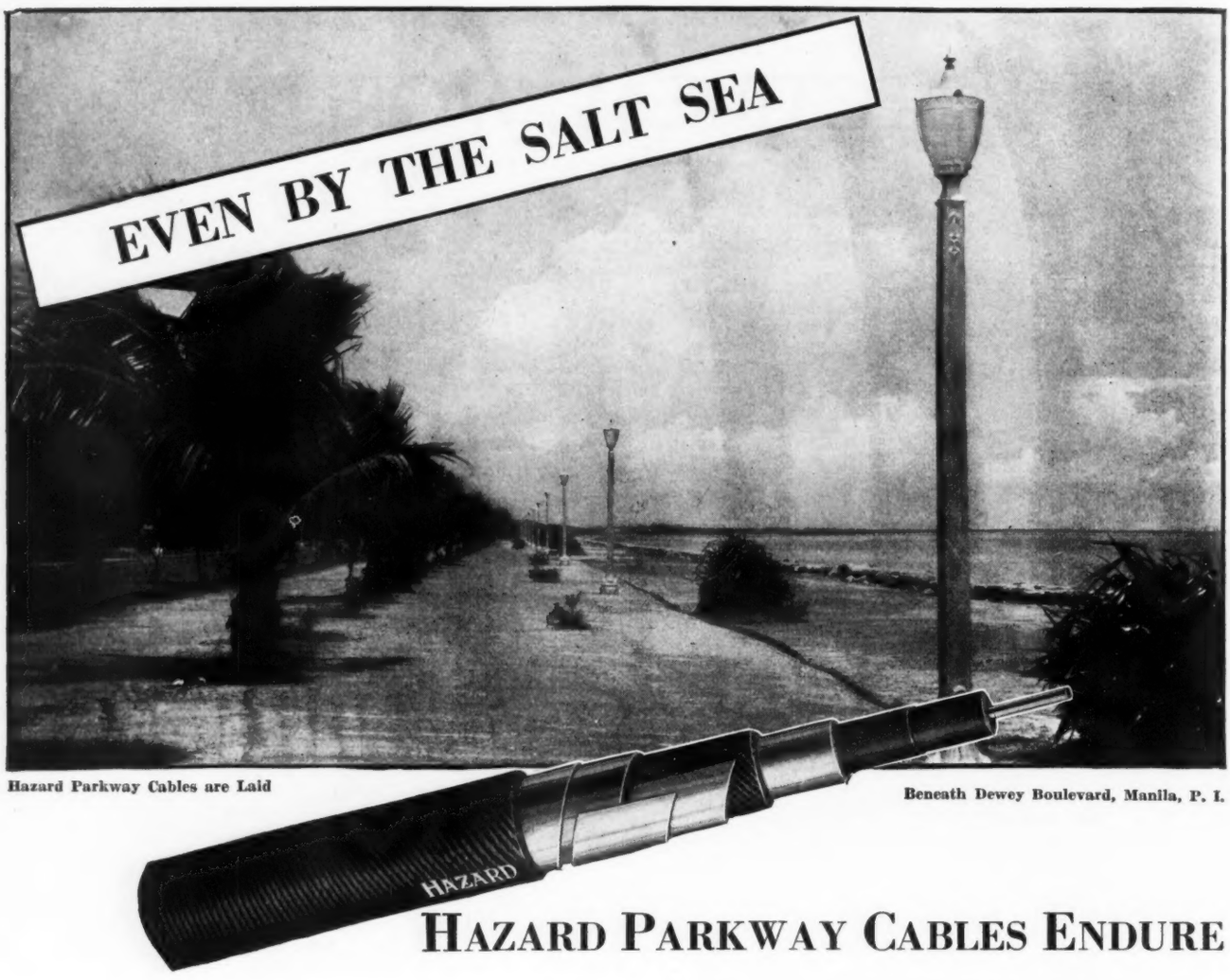

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ELECTRICAL WORLD

for the Week Ending

May 10, 1930

$10,000,000 to Start Boulder Dam

New York Commission Takes Initiative

Muscle Shoals Approval Foreseen

Copper Falls to 12 Cents; Demand Light

—BOULDER DAM nears action stage. Hoover asks Congress for $10,000,000 for preliminary work. Secretary Wilbur assures model construction camp on Puritan lines.

—COPPER at 12-12½ cents stirs demand slightly. Buyers who expect to do all their purchasing at lowest prices often lose out when every one tries to do so at once.

—CENSUS of engineers under way by American Engineering Council. Government classification reduces to four groups. Council plans first comprehensive analysis of profession.

—INSULL properties continue unification. New Hampshire and Vermont are latest to be involved in simplification plan.

—NEW YORK commission accepts the Governor's challenge. Milo R. Maltbie, succeeding Prendergast, criticises Brooklyn Edison for its "unjustified" and allegedly wholesale cut-offs.

—"SECURITY INDIGESTION," says President Simmons of the New York Stock Exchange in analyzing market slump. Utopia is still far away, he concludes, and economic principles have not been abolished.

—BETTER power factors through tangible inducements and restrictive penalties is the quickest way to secure results. Pacific Gas & Electric Company incorporates the idea in its new power schedule.

—CITY wiring bureaus must now bear the burden of introducing innovations. Should not the National Fire Protection Association help? Detroit's chief inspector thinks so.

NEWS OF THE WEEK

Washington Mills Continue Grinding—$10,000,000 for Muscle Shoals

MUSCLE SHOALS preliminaries need $10,000,000 appropriation. Bond & Share properties further analyzed. Power Commission-Couzens-Parker rumpus continues. The mills of the Gods grind slow——.

$10,000,000 appropriation asked for Boulder Dam

While Arizona River Commission officials reiterate their intention to carry Boulder Dam problems to the Supreme Court, alleging unconstitutionality of the Swing Johnson bill, President Hoover has asked Congress for an appropriation of $10,660,000 to cover preliminary work at the site. The Budget Bureau has approved that sum, divided as follows:

Start of four diversion tunnels, ultimate cost $17,000,000	$5,000,000
Spur railroad line to site	2,500,000
Initial power to drill tunnels and start job, either by purchase or building small plant	1,750,000
Confiscation of ranches and mines to be drowned out	500,000
Repayment to Reclamation Fund for expenses over the past ten years	385,000
Three miles of highway	300,000
Administration building and living quarters	125,000
Townsite surveys, water supply, and sanitation	100,000
Total	$10,660,000

The job starts with a spur railroad line either from Las Vegas, Ariz., or Chloride, Ariz. "In either case," says Interior Secretary R. L. Wilbur, "when these spurs have reached the neighborhood of the dam quite a spectacular problem will be encountered. This will be that of getting a railroad down to the bottom of the canyon 300 ft. both above and below the dam site. Beginning at a point 2 miles from the river, a highway must be constructed to the top of the cliffs overlooking Black Canyon Dam site, a distance of 3 miles. This is over rough and precipitous ground.

"The townsite which will be the point of residence for the working force must be laid out. Topographic surveys are to be made and town planners called in. Careful attention must be given to sanitation. A dependable water and sewer system must be installed. Water must be pumped from the Colorado River 800 ft. below. Settling basins and filtration systems modeled on those of such towns of the region as Yuma will be installed." The government will build an administration building and living quarters for its own personnel, but the contractors must provide their own living facilities and must house their laborers.

Independent administration of Power Commission urged

Advocacy by the administration of a Federal Power Commission to be independent of the three departments now responsible for the administering of matters pertaining to water resources is said to have come as a surprise on Capitol Hill. Secretary Wilbur of the Interior Department and Secretary Hyde of the Department of Agriculture, members of the present commission, appeared personally before the interstate and foreign commerce committee of the House of Representatives, which is considering the Parker power bill. Their testimony left no doubt as to the attitude of the Administration.

An explanation being offered by those

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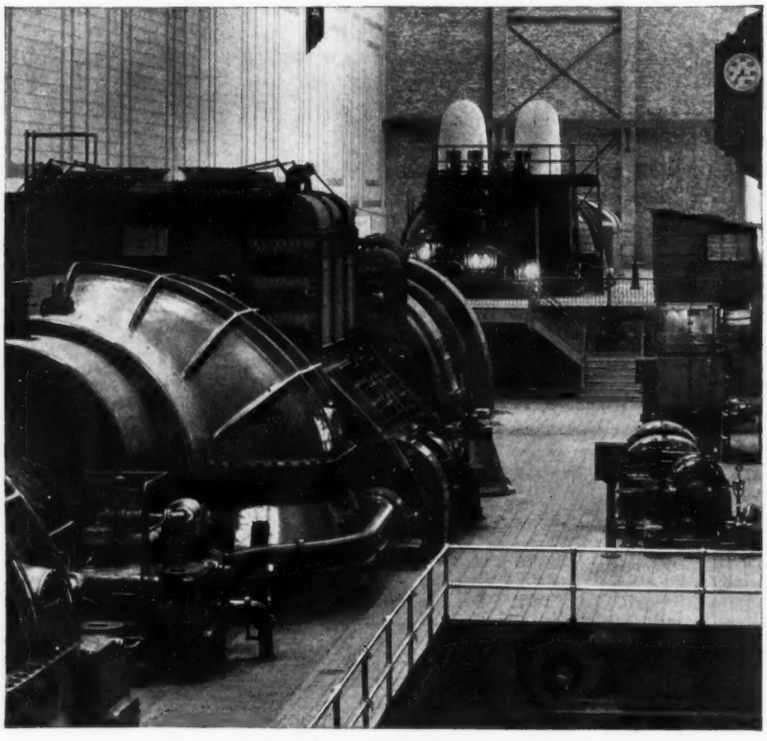
LARGE GENERATORS IN LITTLE SPACE



Strangely enough, the machine in the foreground is of but 60,000 kw. capacity, while that beyond is of the new 160,000 kw. type. Both are in the East River station of the New York Edison Company. Space savings continue to be near-miracles.

MODERN LIGHTING FOR FIRST FLOATING NIGHT CLUB

When the "S.S. Leviathan," pride of the United States Lines, was recently reconditioned, illuminating engineers and interior decorators united to create a distinctive night club for the ship. Lighting involves overhead sources for the dance floor, unit elements for tables and side walls and spotlighting. Nine strips of 150 lamps each with graduated wattages are of clear, green, red and blue over the main dance floor. Hundreds of color and intensity creations are obtainable automatically.

▼ ▼ ▼

who are opposed to the building up of an independent agency like the Interstate Commerce Commission is that the administration is anxious to be rid of direct responsibility in connection with a controverted subject. Opponents of the bill contend that this is the entering wedge looking to the valuation of all power plants and facilities after the manner of the valuation of the railroads.

Parker bill gains further approval

Secretary Wilbur told the House interstate commerce committee that a yearly expenditure of $700,000 would probably be required to maintain the reorganized, full-time power commission proposed in the Parker bill.

Limited action on power control during the current session of Congress is foreseen from the attitude which is now shaping in the House interstate commerce committee. Judging from the questions which are being asked and from the general tenor of committee discussion, it is apparent that the members realize the complexity of utility affairs too thoroughly to attempt any far-reaching changes without long and detailed studies. Therefore it would be surprising if they were to report at this time anything more than a bill to appoint full-time federal power commissioners. It seems probable that they will wait to see if the Couzens bill for this purpose passes the Senate. The question would then be whether the House committee could approve the sections which reduce the control of the three executive departments over federal power matters. Though there is some apparent effort to reach an agreement on this point, chances of any legislation at all this session still seem unpromising.

•

Another Bond & Share property in Trade Commission arena

American Power & Light Company testimony, latest of the Electric Bond & Share properties to be examined by the Federal Trade Commission, was concluded on May 6, with A. E. Lundvall on the stand. It was brought out that in acquiring Kansas Gas & Electric Company, Texas Power & Light Company, Nebraska Power Company, Minnesota Power & Light Company and Florida Power & Light Company the A. P. & L. made write-ups totaling $68,440,931.76, or 124 per cent. The 1927 income to the A. P. & L. on the book cost of seven of its large subsidiaries was 36 per cent.

Attention was also focused on the Electric Power & Light Corporation. Its organization in 1925 under Maine laws was shown to be much the same as that of the older A. P. & L. It is officered, staffed and directed by Bond & Share people. Questioning on this branch of Bond & Share probably will continue through one or more days next week. Investigation of Bond & Share's third subsidiary, National Power & Light, is not ready yet and may be postponed indefinitely.

Mr. Lundvall, commission accountant, answering from his exhaustive report under Judge Healy's questioning at earlier meetings, showed how American Power & Light Company was chartered under Maine laws and vested with the shares of various companies held by Bond & Share. A syndicate was formed whereby Bond & Share held 60 per cent of the A. P. & L. stock, or $1,500,000, and W. P. Bonbright & Company held 40 per cent, or $1,000,000. The latter transferred most of its shares to Bond & Share officers and others who were designated. Stock to the value of $8,000,000 were issued. The total profit to Bond & Share as a result of its organization of A. P. & L. was given as $348,255.

Engineering Council Census to Classify Engineers

MORE than 100,000 professional engineers throughout the United States will be listed by the American Engineering Council in a special census to provide one of the most comprehensive cross-sections of the profession yet obtained. This census will supplement that now being made by the United States Census Bureau. At the same time it will supply a large volume of information which is vital to engineers, colleges and technical schools and which would be unavailable, it is pointed out, under the enumeration system employed by the Census Bureau.

In the government's questionnaire professional engineers are grouped in four classes. Professional men objected that none of the titles clearly or accurately described the manner in which they earn their living. It was pointed out that to include consulting engineers in any one of the four groups—civil, electrical, mechanical or mining—was illogical, because there are consulting engineers in each of the four groups. It also was argued that it is highly desirable to know accurately how many engineers are employed by municipalities, states and the federal government. No distinctly different classification was afforded which would make it possible to determine these facts.

An effort will be made to cover eleven classifications of engineers. It has been urged that every sort of problem affecting the employment of technical engineers, their geographic distribution, overcrowding in the profession, and the establishment of technical schools, involves the accuracy of the census.

The special census which the Engineering Council now has under way has been in preparation for about a year. It will not cover every professional engineer, the council explains, but the results of the study will be valuable to engineers and to technical institutions which otherwise would be dependent upon the less detailed facts adduced by the government.

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BOSTON'S MAYOR STARTS CONSTRUCTION OF RIVETLESS EDISON BUILDING

The first electric weld in the erection of the new office building of the Edison Electric Illuminating Company of Boston was made last week by Mayor James M. Curley. "Sound movies," motion pictures and "stills" were taken to contrast the quiet and convenience of electric welding with the driving of a temporary rivet in the structure by the old method. About one mile of welding will be required for this building, which will contain 1,200 tons of steel. Here are Mayor Curley and President C. L. Edgar and Julius Daniels of the Edison Company.

Muscle Shoals Approval Foreseen in House

AFTER deliberating for three weeks, the House committee on military affairs approved, on May 6, the new Muscle Shoals bill prepared by its drafting subcommittee. Early passage is foreseen as the next step, whereupon the measure will go directly to conference before resubmission to the Senate. This short cut is made possible by carrying the number of the Norris resolution which passed the Senate, though all the Norris language is stricken out. These efforts will probably be useless, however, as Senate acceptance of the House bill is thought hardly to be expected during the current session of Congress.

Technically the bill is considered to be a good one. It kills the government ownership scheme by providing private leasing. It disqualifies power companies as bidders, thus removing the "power trust" issue. It permits the President to go ahead and get rid of the Shoals without further Congressional action.

In more detail, what the bill does is to empower the President to appoint without confirmation a board of three eminent citizens, one of whom is identified with agriculture. The board is to appraise the property and then to lease it on the best terms possible for fertilizer, ferro-alloy and other electrochemical production.

▼

Don Pedro Dam to Become a California Power Site?

APPLICATION has been made by the Turlock and Modesto irrigation districts in California to the Federal Power Commission for a license authorizing the districts to flood certain public lands by installing gates at the existing Don Pedro Dam, thereby raising the level of the reservoir 10 ft. The Don Pedro reservoir originally was an irrigation project. The additional storage would be used for the generation of power. It is planned to install 40,000

hp. to be distributed throughout the two districts and for sale to public utility companies.

▼

Massachusetts Hearings of Power Companies Close

HEARINGS of utility company control and regulation before the Massachusetts legislative committee on power and light were brought to a close last week. Sheldon E. Wardwell, counsel for the Massachusetts Gas and Electric Association, was the final speaker.

Opposition to the proposed contract law as a rate base was Mr. Wardwell's chief contention. He declared the bill to be grossly unfair and confiscatory; that it would require a public utility to enter into contract with the state, in effect guaranteeing not to press the theory of reproduction, or otherwise to face possible competition from municipal plants.

Policies of New England Power Association defended

Details of the business of the New England Power Association, which he said had been described as a "power trust" and "the octopus" and "other benevolent names," were pointed out before the committee by Frank D. Comerford, president of the association.

"We have one of the most efficient power systems in America," he contended. "To build this system required the holding company. We are not stock jobbers, nor promoters. We have bought control of no electric company in Massachusetts to milk it. Our expansion has been along a carefully thought out plan to integrate, join together physically, under common operation, the properties in Massachusetts that economically should be joined together, to the end that the natural resources of this area could be developed and the lowest cost power made available for the public."

"We do plead guilty to the vastness of our company," conceded Mr. Comerford, "and we are proud of it. As to its beneficence, I will leave the answer to the public whom we serve."

▼

New Transmission Ties Improve Eastern Systems

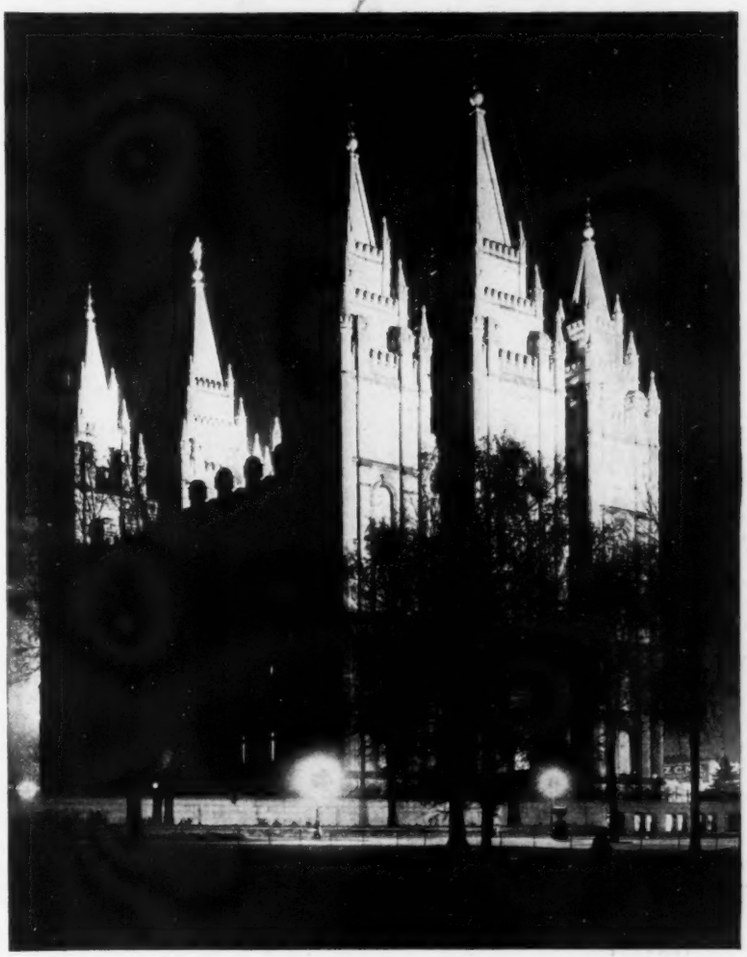
AN IMPORTANT step in the utilization of the resources of the Niagara Hudson Power Corporation system to the greatest advantage throughout New York State was brought about during the past few days with the completion of a new 24-mile, 110,000-volt line between Johnstown and Rotterdam by the New York Power & Light Corporation.

The section just completed is the final link in a main 110,000-volt trunk line across the state, the route being from Jamestown on the west to Stephentown, where the line connects with the main transmission system of the New England Power Association, extending thence to Boston, Mass.

This main power artery is 500 miles long and into it connects the entire power resources of the Niagara Hudson and New England systems. The Niagara Hudson has generating resources of 1,652,680 hp., including 54 hydro-electric stations with a total of 1,149,980 hp. capacity and five steam stations with a capacity of 502,700 hp.

Interconnection has also been completed between the electric systems of the Public Service Electric & Gas Company and New Jersey Power & Light Company, enabling an exchange of electric energy between the two companies and insuring continuous service in face of any emergency.

SALT LAKE CITY CELEBRATES WITH LIGHT



In observing the recent centennial of the founding of the church of the Latter Day Saints, the Mormon Temple in Salt Lake City, Utah, was silhouetted in the manner of 1930.

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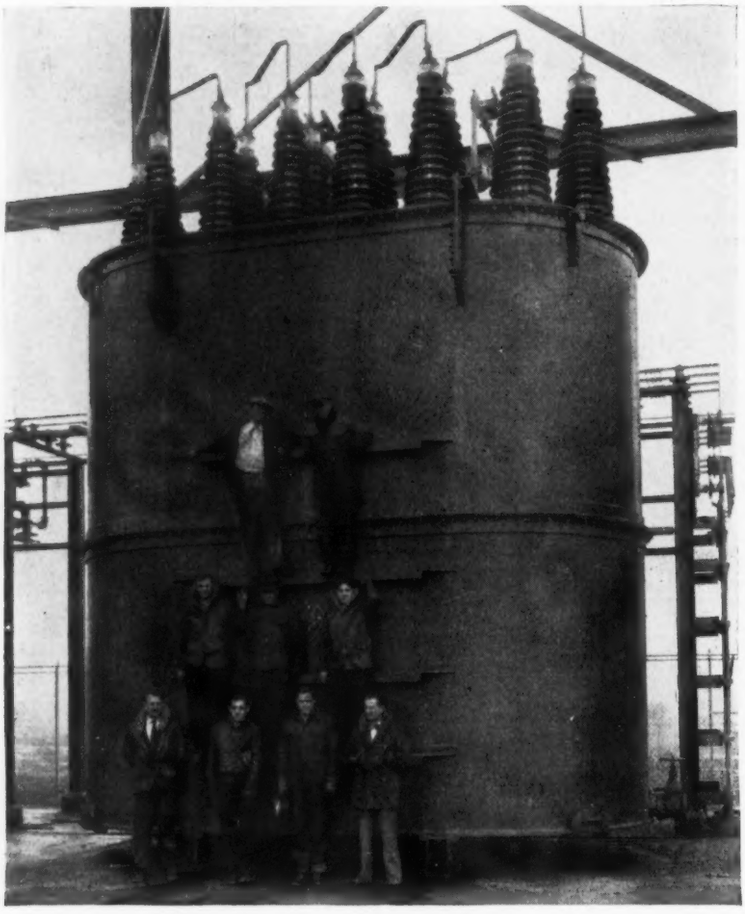
Locating Industrial Plant a Science, Group Decides

LOCATION of industries at logical points is becoming an exact science. This was indicated at the recent conference of Industrial Bureau Managers at the Chamber of Commerce of the United States in Washington. Ninety managers of bureaus were in attendance. Their reports indicate that increasing funds are being made available for research and for engineering studies looking to a more exact knowledge of conditions bearing upon plant location.

Some managers in attendance were bold enough to contend, in the face of some manifestations of incredulity, that they turn away industries when their studies show they would do better elsewhere. In contrast with those claims was the statement by Harold V. Coes, of Ford, Bacon & Davis, that it is very difficult to get industrial bureaus to reveal adverse facts.

1,250,000 KVA. FOR SWITCHGEAR TESTS



Two transformers which for two seconds have a capacity of 1,250,000 kva.—well over a million and a half horsepower—have been installed at the Schenectady works of the General Electric Company. This maximum capacity is more than twice as great as the installation of the Niagara Falls Power Company, which is rated at about 556,000 kva. The equipment will be used with a 100,000-kva. generator. Normal rating of each is 33,333 kva. and they are said to be the largest yet built for testing work.

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Architectural Lighting Conference for Chicago

COLLABORATION between the architect and the illuminating engineer will, it is expected, be further aided by the architectural lighting conference which is to be held in the Chicago Lighting Institute, May 13 to 15. The three elements interested in the conference, architecture, illumination and electricity supply, will be represented by men prominent in their groups; among the architects, C. W. Farrier, Ralph H. Hammett and A. N. Rebori; among the lighting engineers, M. Luckiesh, H. E. D'Andrade, Ward Harrison, Prof. H. H. Higbee and H. H. Magdsick, and among the utility men, E. W. Lloyd and R. J. Malcomson. This meeting will be the first of national importance to be held in the Chicago Lighting Institute and will mark the début of the institute as a functioning entity.

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Canadian Train-London Telephone Calls Made

ANOTHER epoch in telephony was marked last week when Sir Henry Thornton, president Canadian National Railways, traveling from Toronto to Montreal aboard the fast International Limited, communicated by telephone with C. J. Smith, European vice-president of the same road, then in London, England. Others on the train and in London also spoke.

"Just like any other telephone conversation," said C. A. Dunning, Minister of Finance, in expressing his impressions. The hook-up was used to signalize the institution of regular service between trains and exchanges in connection with speeding up Canadian National travel between Chicago and Montreal.

▼

Judges Who Are Consumers Recused in Rate Cases

IN TWO cases judges in the Circuit Court at Mobile, Ala., have recused themselves in trials involving power rates of the Alabama Power Company. In both cases the power company, as defendant, moved on the ground that the judges were consumers and in case of any rate reduction would benefit thereby.

In the last case the city of Mobile carried the case to the state Supreme Court on a writ of mandamus seeking to compel the judge to hear the case. The higher court denied the writ, holding that the court was justified in recusing itself. The chief justice of the Supreme Court will be asked to send a judge from elsewhere to try the Mobile case, in which rates similar to those in Montgomery, Ala., are sought.

▼

Brooklyn Shut-offs Scored by Commission

A WARNING to the Brooklyn Edison Company that its cut-offs and discontinuance of service, allegedly without justification, must be reduced was given by Milo R. Maltbie, chairman of the New York Public Service Commission, at a hearing on Monday. The hearing was in accordance with Governor Roosevelt's pronounced policy that the commission should adopt an aggressive attitude in safeguarding the interests of consumers and initiate proceedings to do so.

William L. Ransom, counsel for the company, presented a tabulation showing that from the beginning of 1927 to March 31, 1930, the company had made 186,993 cut-offs for non-payment of bills and that in only 140 of these cases had there been claims of error on the part of the company. Mr. Maltbie challenged the accuracy of the latter figure, asserting the commission had received many more complaints of unjustified discontinuances.

"Granting, however, the low percentage set forth by the Brooklyn Edison Company," Mr. Maltbie said,

"that is not the question before us. The question is why the number of cut-offs without apparent justification by the Brooklyn Edison Company is proportionately larger than other electric companies in New York City.

"No matter what the regulations are," the chairman continued, "if the company wants to be harsh and rigid and give no leeway, the number of cut-offs will continue to mount.

"The deprivation of service without adequate reason is one of the worst things that can be done by the utility to the consumer.

"The Brooklyn Edison Company must lessen the cut-offs without reason to the level maintained by the other companies."

The proceeding was adjourned without date to give the company time to lessen the abuses charged to it by the Public Service Commission.

▼

Muscle Shoals Aids in Prolonged Drought

A LONG drought has so depleted the water supply on the Coosa and Tallapoosa Rivers that the Alabama Power Company is now using, daily, more than 1,000,000 kw.-hr. generated at Wilson Dam, Muscle Shoals, according to an official announcement. On Wednesday, April 30, the first big day, 1,375,000 kw.-hr. was accepted. Use will continue until rain falls in the Coosa and Tallapoosa Valleys.

Power from the government-owned Wilson Dam is taken principally during the summer months, when water is low in the rivers on which most of the company's hydro-electric projects are located. Under the contract with the federal government, the power company uses a minimum of $560,000 worth of power per year from Muscle Shoals.

▼

South Carolina Consumers to Form Rate Body

A STATE-WIDE organization of power users for the avowed purpose of securing equitable and uniform electric rates has been formed in South Carolina, a charter having been issued by Secretary of State W. P. Blackwell to the South Carolina Electric Power Consumers' Association.

The purpose of the organization is stated to be "to do all things necessary to the end that the rates on electric power for consumers in this state shall be made fair, equitable and uniform," and it is compiling data on rates in this and other states.

Representatives of nineteen cities and towns, including more than 60 corporations, are stated to be members of the association.

Distinguished Talent for World Power Conference

AN IMPOSING array of scientists, engineers, economists and executives will assemble from 49 countries for the World Power Conference in Berlin, June 16-25 (ELECTRICAL WORLD, page 823, April 26, 1930).

Recent advices add new names to the list of distinguished speakers, which includes: Prof. Albert Einstein, D. N. Dunlop, under whose leadership the first World Power Conference met in 1924; Prof. Arthur Eddington, English research worker; C. F. Hirchfeld, Detroit Edison Company; G. A. Orrok, consulting engineer; W. L. R. Emmet, General Electric Company; Prof. D. Serruys, French savant and economist, and Dr. Oskar Oliven, German superpower authority. Thomas A. Edison will participate through the medium of the talking picture.

Official delegates of the American Institute of Electrical Engineers to the conference will be A. E. Kennelly, professor of electrical engineering Harvard University; I. E. Moultrop, chief engineer Edison Electric Illuminating Company of Boston; L. T. Robinson, General Electric Company; L. W. W. Morrow, editor ELECTRICAL WORLD, and Clayton H. Sharp, technical director Electrical Testing Laboratories. O. C. Merrill is chairman of the American committee.

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1,165-FT. CARPENTER DAM NEARS COMPLETION

Carpenter Dam, second of three hydro-electric developments being made by the Arkansas Power & Light Company on the Ouachita River, will be 115 ft. high and nearly ¼ mile long. Part of a planned 200,000 hp. for this stream, it will be of 32,000-hp. capacity. Flood prevention is part of the three-station scheme

Pend Oreille Decision Reserved—Interests Parry

STRUGGLE for control of the water powers of the Pend Oreille River in British Columbia continues. The Reeves-Macdonald Mining Company has announced definitely that it will not attempt to open up its large mineral properties near the Pend Oreille unless it is allowed to develop power of its own there. It will not purchase power from the West Kootenay Power & Light Company for this purpose as contemplated by the provincial government in a recent decision.

The Reeves-Macdonald company is prepared to waive all objection to the West Kootenay's power plans (ELECTRICAL WORLD, page 822, April 26, 1930) so long as it is allowed to develop its own power at a dam site for which it has already applied. If the power company's proposed dam floods the Reeves dam the mining company will ask no compensation, but if the dam threatens to flood the Reeves site then the latter will be willing to compensate the power company for cutting down the size of its dam by supplying it with the power thus lost or by allowing the power company to join with it in a joint power scheme.

The West Kootenay company proposes to develop the entire flow of the Pend Oreille by whatever scheme of development appears most satisfactory to its engineers. These facts emerged from a recent hearing of the West Kootenay company's application covering its proposed dam at Cedar Creek, near the mouth of the Pend Oreille. To this the Reeves-Macdonald interests took strong objection, charging that it was an attempt to freeze them out of the river altogether. The Water Board reserved its decision on the whole issue.

▼

30,000-Kw. Steam Plant for Sheboygan, Wis.

WORK will soon be started by the Wisconsin Power & Light Company on construction of a 30,000-kw. steam-electric generating station at Sheboygan. The plant when completed will be one of the few large generating stations of its type on the Great Lakes.

The first unit will have a capacity of 30,000 kw. and provisions have been made for addition later of another unit of the same capacity. Located on a 175-acre tract of land on the shore of Lake Michigan, about half a mile south of Sheboygan, an ample supply of condensing water is available from the lake. Lake freighters will deliver coal directly to the bins of the plant.

Steam will be superheated to a temperature of 825 deg. F. and delivered to the turbines at a pressure of 600 lb. A steel tower line operating at 132,000 volts will link the station with the company's high-voltage transmission network.

Listen and Learn, Advises Gadsden of U.G.I.

"THE problems of public utilities in the future will be largely in the field of public relations," Philip H. Gadsden, vice-president of the United Gas Improvement Company, said before the Pennsylvania Gas Association last week. "Criticisms of service, common twenty-five years ago, now are rarely heard.

"At the present time discussion of public utility matters is concentrated," said he, "not so much on contractual connection between company and customers, as on the relations between the industry and society as a whole. The inquiry is not whether certain practices are legal, but whether, under the changed economic and social conditions, they are in the public interest.

"During the period of readjustment of our public relations, we should welcome constructive criticism and give sympathetic consideration to suggestions from whatever source they may come, bearing in mind that we have not always been right in the positions that we have taken in the past, notably in our determined opposition to the establishment of public service commissions.

"The criticism of our rates, wherever it is found, is based largely on the feeling that such rates have been constructed to yield a return on excessive and inflated values of the properties which are devoted to the public service."

Property values, in rate making, are losing importance, he concluded.

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POWER LAKE TO HAVE 1,500-MILE SHORE LINE

"Lake of the Ozarks" is the name suggested for the body of water which the Bagnell Dam of the Union Electric Light & Power Company will create. This 210,000-hp. development on the Osage River will be 110 ft. high and the lake formed will be 96 miles long, covering 86 square miles. One of the largest developments planned or possible in the State of Missouri, it will raise the output capacity of the Union Electric system to over 730,000 kw.

Coming Meetings

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 18-23. E. H. Hubert, 420 Lexington Avenue, New York.

East Central Division, N.E.L.A.—Hotel Statler, Cleveland, May 20-23. D. L. Gaskill, Greenville, Ohio.

National Electrical Credit Association—Hotel William Penn, Pittsburgh, May 22 and 23. F. P. Vose, 140 South Dearborn St., Chicago.

National Electrical Wholesalers' Association — Hot Springs, Va., May 26-30. E. Donald Tolles, 165 Broadway, New York.

American Electrochemical Society — St. Louis, May 29-31. C. G. Fink, Columbia University, New York.

North Central Division, N.E.L.A.—Managerial Section, Alex. Johnson Hotel, Rapid City, S. D., June 11-12. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Canadian Electrical Association — Manor Richelieu, Murray Bay, Que., June 11-13. H. M. Lyster, 405 Power Bldg., Montreal.

Pacific Coast Division, N.E.L.A.—San Francisco, June 16. S. H. Taylor, 447 Sutter St., San Francisco.

National Electric Light Association—San Francisco, June 16-20. A. J. Marshall, 420 Lexington Avenue, New York.

Wisconsin Utilities Association—Accounting Section, Eau Claire, June 19 and 20; Electric Section, Lorain Hotel, Madison, July 17 and 18. Commercial Section, Green Bay, July 31 and August 1. J. N. Cadby, 105 Wells St., Milwaukee.

American Electric Railway Association—San Francisco, June 21-26. Guy C. Hecker, 292 Madison Ave., New York.

American Institute of Electrical Engineers—Summer convention, Toronto, June 23-27, F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Haddon Hall, Atlantic City, N. J. June 23-27. C. L. Warwick, 1315 Spruce St., Philadelphia.

Association of Electragists International—Hotel Schroeder, Milwaukee, August 18-20. L. W. Davis, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Northwest Section, Bellingham, Wash., Aug. 25-27. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

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Houston Profit-Sharing to Lead to Tax Suit

FIRST steps in a movement to obtain a refund of $500,000 on federal income taxes paid during 1922-29 by the Houston (Tex.) Lighting & Power Company have been taken by the city.

Under terms of a profit-sharing agrement between the city and Houston Lighting & Power Company the two share equally in all excess profits, after the light firm has been allowed operating expenses, 4 per cent return on the investment for depreciation and 8 per cent profit.

It is the contention of the city that a municipal government is tax exempt. Since the city participates in the profit of the lighting firm, the lighting firm should not be required to pay income tax on but half of its profits.

Half of the income tax paid the federal government by the light firm for the years 1922-29, inclusive, should have been paid to the city, it is contended.

Application for refund of $243,850 for three years has been made to the local collector of internal revenue. Application for the remainder, bringing the total to around $500,000, is to be made later.

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Scottish Grid Scheme Makes Good Progress

FOR the central Scotland power project of the Central Electricity Board of the United Kingdom the essential feature involves erection of about 250 miles of 132-kv. transmission lines for linking up the water-power and steam-power generating stations in the area, and the main purpose is to unify the control of all the large generating stations in Scotland, ultimately eliminating the older and less efficient stations.

Arrangements are being made by the Grampian Power Company to transmit energy from its new hydro station at Loch Rannoch to the board's grid lines at a point near Aberfeldy, and it is expected that the large interconnected system which the board's lines will make possible will lead to further development of the extensive water powers of the Scottish Highlands. The lines which the board may construct later between Kilmarnock and Carlisle will, on the other hand, permit of the development of the water-power possibilities of Kircudbright County—estimated at 136,000 hp.

In west Scotland the systems of the Corporation of Glasgow and the Clyde Valley Electrical Power Company operate on the non-standard frequency of 25 cycles, and the plans of the board provide for the standardization of all the plant in this area at 50 cycles. The estimated cost of this part of the work is $19,000,000. It is hoped that by the spring of 1932 all Scotland will employ a frequency of 50 cycles.

On April 30 the extension to the Portobello power station of the Edinburgh Corporation will be inaugurated. This includes two 31,000-kw. turbo-generators. The closing of the switches at this station will connect the east coast of Scotland with the west, thus permitting power to be transmitted backward and forward between Glasgow, Greenock, Paisley, the Clyde Valley Company's stations, those of the Scottish Central Electric Power Company at Bonnybridge, and the corporation of Edinburgh. Provision has been made for an extension later to Dundee.

ANOTHER LANDMARK FOR SAN FRANCISCO

—*Wide World Photos*

Progressive here as in other things, Sir Henry Deterding of the Shell Oil Company has just completed a beautiful and distinctly modern $4,000,000 office building for the California headquarters of his organization. Floodlighting has been effectively used to advantage.

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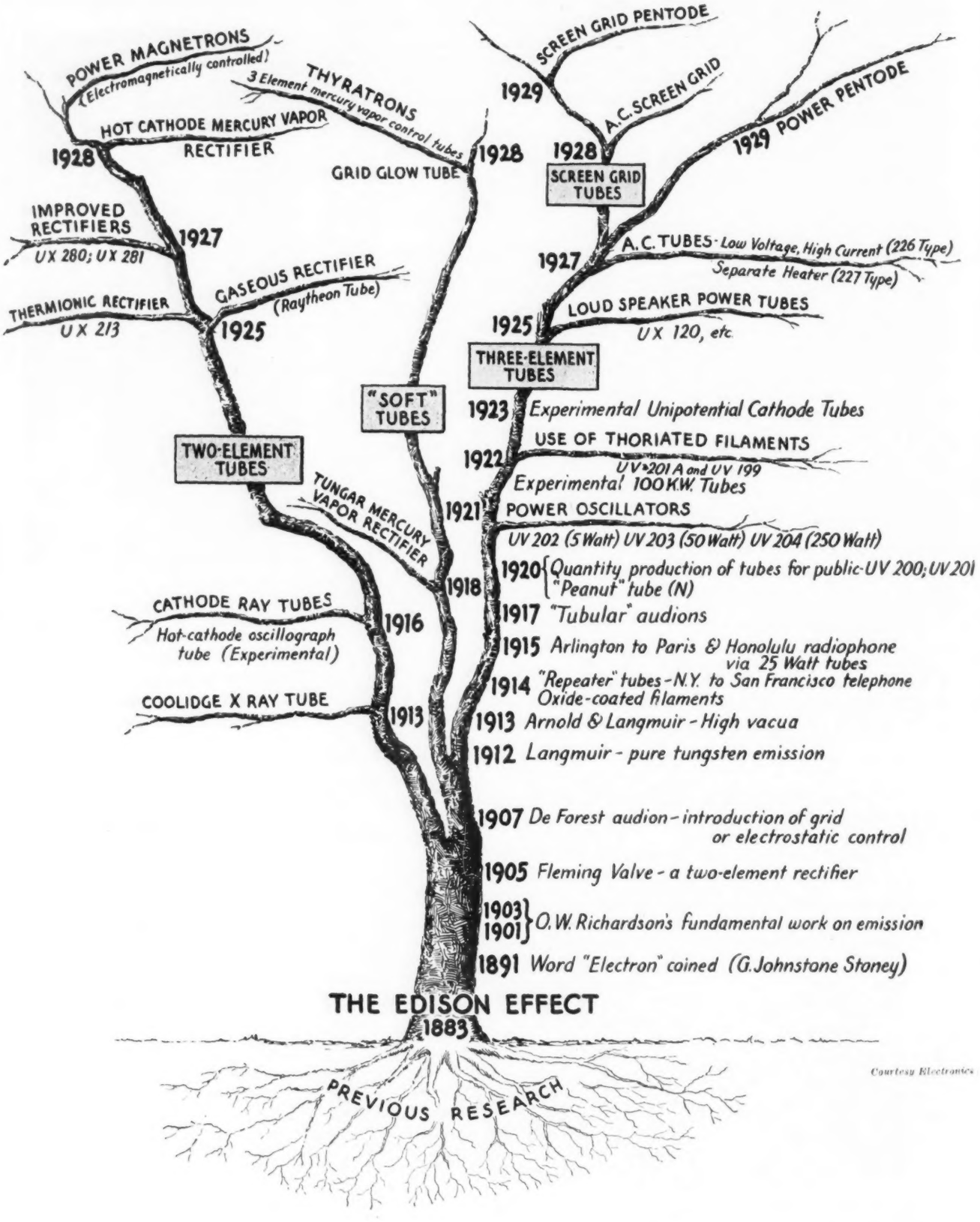
New Hampshire Properties Plan Insull Merger

CONSOLIDATION of all the Insull properties in New Hampshire will result if the Public Service Commission of that state gives its approval to certain applications now pending before it. Merger is planned under the Public Service Company of New Hampshire.

Transfer of properties of the Twin State Gas & Electric Company in New Hampshire to the Public Service Company of New Hampshire is involved. The Vermont properties of the Twin States company will be placed under the Central Vermont Public Service Company at the same time.

Petitions also are before the commission to allow the Public Service Company of New Hampshire to acquire the Bethlehem Electric Company and the Lisbon Light & Power Company. The four companies, all controlled by the Insull interests, have plants valued at about $35,000,000 in New Hampshire.



Courtesy Electronics

FAMILY TREE OF THE ELECTRON TUBE

EDITORIALS

L.W.W. MORROW
Editor

The Stone Age Still Persists

THE electrical industry and other industries which use electricity extensively in their processes take pride in being progressive. They have good reason for doing so. But two practices still persist in many business relationships that hark back to the Stone Age or farther—reciprocity and bargaining. Reciprocity is manifested in such statements as "I buy from you, so you should buy from me," or "I will purchase from you if you will purchase from me." Bargaining is evident in the comments, "Company A offered me a lower price; you will have to meet (or better) it," or "If you will give me all your business, I will undercut Company A 25 per cent on this order."

It is difficult to understand how any seller with an ounce of pride in his reputation will succumb to such practices. Either buyer or seller who suggests reciprocity relinquishes all rights to having products considered on their merits. Once a seller has submitted a price, further reduction is an indication that he is horse-trading. The buyer is left with the definite impression that he can never be sure the first price is the lowest obtainable.

Where do these practices lead? Into a maelstrom. For the seller, no new field of business is created. Confidence in the merit of his product is destroyed. Cutting prices below a profit-making basis eventually leads to bankruptcy or continued loss in the department which practices it.

For the buyer, these practices prevent selection on merit, handicap the seller financially in development and servicing, and if continued will lead to a limited field of purchase, with all its objections.

Any seller who doubts the futility or hazard of reciprocity might analyze where his market will be confined if reciprocity is carried to the extreme. If he thinks price cutting is advisable he had better analyze the net profits of the department where it is practiced. It is also worth remembering that participating in reciprocity or bargaining just lends impetus to the inevitable result. Isn't the electrical industry above Stone Age practices, even though other industries follow them?

Duplicate Service to Industries?

DURING a recent trip of McGraw-Hill editors through New England, the policies of numerous industrial plants as to the purchase of power were often informally discussed with manufacturers. It was illuminating to find that in not a few cases the decision to buy or not to buy rested upon the ability of the power company or system to provide and maintain service of as good quality as could be rendered by a high-grade plant at the factory. The price per kilowatt-hour appeared to be a secondary element in many instances, assuming a fairly close approximation to equality in over-all power costs. The highest hurdle for the power company to leap was declared to be virtually uninterrupted service with regard to processes involving heavy spoilage in case of shut-down and in situations associated with heavy labor costs in case of emergency supply failure beyond momentary periods.

In a word, there is a growing demand for the preparation of what might be called a "reliability balance" in which the cost of maintaining a particular standard of service in the isolated plant will be set against the reasonably guaranteed practice of the power system outside.

An evaluation of the cost of reserve capacity inside the manufacturing establishment versus reserve facilities in utility stations, lines, feeders,

and of course interconnections where available, must be made by utility and industrial electrical engineers. To borrow a medical term, duplicate service may or may not be economically "indicated" as the proper treatment.

Making Interconnections More Effective

IN AN area about 120 miles long by 100 miles wide containing some half dozen industrial cities and intermediate rural territory interconnection has proved itself almost invaluable during the past few months. Rainfall has been alarmingly deficient and water-storage facilities, never large with respect to the score or so of hydro plants tied together, have been husbanded with care. It has been necessary to lean heavily upon steam auxiliary stations. In the old days interconnections between the districts were mainly of the "shoestring" variety, but within the past two or three years the larger area has been taken in hand and two major trunk lines have been built and co-ordinated to provide north-and-south and east-and-west axes for 66-kv. transmission and in some sections for 110-kv. service. What has been the result of this foresight?

The provision of what might be called electrical co-ordinates up and down and across the area has enabled the operating organizations within it to get a stranglehold upon the water flowage above and through their hydro developments. The good old factor of watershed diversity is now utilized for all it is worth. The provision of line voltages of at least double those formerly employed has benefited the entire area through improved voltage regulation and reduced lines losses which conserve water, and—perhaps even more desirable than this—has given increased value to more distant "insurance" interconnections. It has been found difficult to make much use of reciprocal industrial power contract facilities in parts of the area during the present shortage of rainfall, but the new trunk lines have in a sense annihilated so many miles of cross-country barriers to energy interchange that the whole region is living in a new electrical day and night.

What Next in Electrical Science

TWICE each day, according to Professor Fernando Sanford, insulated objects near the earth's surface change their electric charge about 200 volts—positive in daylight and negative at night. This effect is presumed to be caused by the interaction of electric charges on the sun and on the earth. Perhaps this explains terrestrial magnetism and perhaps it is the motivating force in many physiological and biological phenomena. Human beings sleep better at night, some plants close their flowers at night, some animals sleep only at night. Might not the effect of these electric charges on insulated structures explain this phenomena?

Then, again, at the Academy of Science meeting it was claimed that electricity is responsible for memory. An electric charge creates a permanent plate in the brain cell structure corresponding to a thought or emotion, and this becomes a memory phenomena when a similar charge sensitizes the plate at a later time. If scientific facts and speculative conclusions from experimental data continue to be brought forth we will soon call electricity the Alpha and Omega of creation.

Big Brother's Trousers and Obsolescent Meters

OBSOLESCENCE of watt-hour meters—what does it mean? A certain meter might be regarded as obsolete by one utility, but the thrifty salvage agent of that utility might have little difficulty in persuading a submetering company, a building superintendent, or even a smaller central station, that this identical meter differed only in insignificant detail from newer types on the market. A meter obsolete in one situation may be, and frequently is, new in another.

Motor-car dealers, finally desperate over the accumulation of archaic puddle jumpers and senile sedans on their hands, sometimes dispose of the problem by staging a spectacle of destruction for its advertising value. That occasional practice in the automobile industry might in the electrical industry be made the regular practice for the disposal of old meters. It is followed by meter manufacturers quite generally, although without

the motor-car dealer's spectacular staging, the custom being to dispatch with an axe all meters taken in as allowance on new purchases.

But, naturally enough, manufacturers who follow this policy cannot afford to be open-handedly generous with allowances for old meters. A utility can easily discover second-hand equipment dealers, submetering companies or others ready and willing to hand over cash in excess of the manufacturer's allowance. A utility says, in effect, when it replaces old meters with new ones: "These old meters are not up to our standard of accuracy and precision." Then, selling the old meters for reinstallation, it says: "They are not good enough for us, but they are all right for you."

How inconsistent it is for a central-station company to make virtue of meter accuracy as applied to its own operation and then to deny that virtue to other meter users! The practice must inevitably result in a questioning of the accuracy of all meters. The only way it can escape this unfortunate comparison is to refuse to sell its old meters for reinstallation.

Ground Chains That Do Not Ground

WHEN a line foreman has seen that the ground chains are tightly snagged down on both sides of the section where his gang is working, he feels that the men are protected. But it has happened that a lineman, thus confident of safety, has received a jolt in spite of the ground-chain protection. The reason for this, as shown by the investigations of Royce E. Johnson on ground-chain breakdown voltages, reported in this issue, is that the time lag between voltage application to the chain and current flow in it is really long in terms of electrical speed.

The cause for this condition is the presence of oxides and salts on the surfaces of the chain links. One is driven to the conclusion that the most effective method of grounding a line is by the use of copper cable fitted with clamps that can be firmly attached to the line conductors. Cable lacks the flexibility and ease of handling that a chain possesses and line crews would probably object to bothering with clamps on the ends of "hot sticks" in the case of distribution lines and the lower transmission voltages. Possibly the solution for these lines, as suggested by Mr. Johnson, lies in plating a grounding chain with a non-corrosive metal, possibly chromium, or in the use of one of the non-corrosive steels which are the pride of modern metallurgy. Particularly is it important to have adequate non-corrosive plating between links.

Maintain the Balance by Customer Sales

CERTAIN of the larger power and light systems have recently expanded their customer sales efforts. In this way they are finding a market for junior securities and are able to maintain balance in their capital structures, at a time when the public securities market is not receptive to junior issues.

Abnormal market conditions since October have distorted the usually well-maintained balance between stock and bond financing. Out of $400,000,000 of new public financing for the first quarter of this year bond, debenture and note issues accounted for 92 per cent, while but 8 per cent was in stocks. Taking the six-month period ending March 31 bond and debenture financing accounted for 89 per cent and stock financing but 11 per cent. The increment added to the industry's capitalization during the past six months thus has been thrown out of line in regard to proportion between junior and senior financing, normally somewhere around 40 and 60 per cent respectively. The figures quoted, however, do not include rights and stock sold to customers, totals for which have not been large this year to date.

If anything like the old balance is to be maintained, large-scale promotion of customer ownership is strongly suggested by the circumstances, especially in view of its strategic value to the companies. The decline in customer sales noticeable during the past two or three years is regarded as unfortunate by some of the industry's leaders, and the fact that some of the largest companies may launch intensive campaigns in the near future is suggestive.

Carrier Works When Wires Fail

ELECTRIC power service has become so commonplace that it is frequently accepted, along with modern commodities, by industrial users without realizing how closely it is interwoven with their daily lives until something causes it to be interrupted.

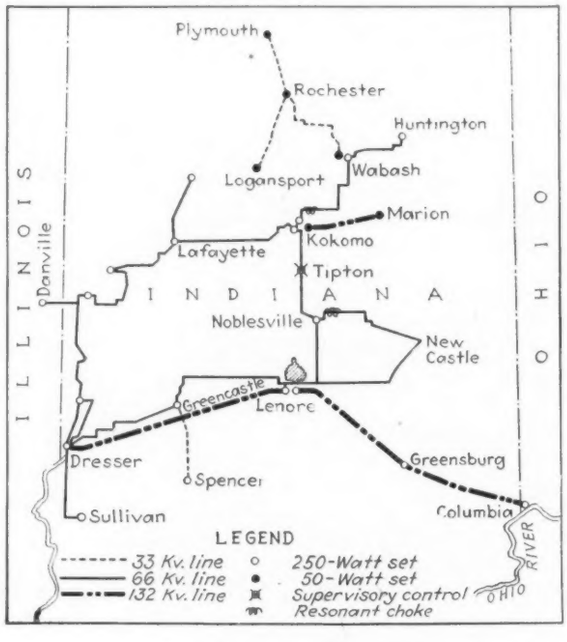
CONTINUOUS uninterrupted service is the first rule of operation which all power companies must meet above everything else. Such operation in these days of extensive high-tension systems and interconnections with other systems is dependent in great measure upon adequate and reliable communication. Efficient system dispatching and operation is a task of vital importance and justifies the use of the most modern and reliable means of communication available.

FEATURES of the carrier-current communication equipment used by the Central Indiana power group and particularly experiences therewith are related in this article.

THE success of the initial carrier-current installations made by the Central Indiana Power Company's subsidiaries in 1924 prompted the extension of this communication system until, at the present time, it is applied to the entire primary high-tension system and even to intercommunication with associated interconnected companies. The carrier-current communication system, as shown on the map, is applied chiefly to the 66-kv. and 132-kv. lines, although it is applied in part to the 33-kv. lines. A total of nineteen 250-watt duplex Westinghouse sets constitute a complete primary communication backbone by means of which the system dispatcher at the Lenore substation can gain immediate contact with any of the important stations on the 66-kv. and 132-kv. system. In addition, a small secondary, independent system is composed of four General Electric manually operated simplex sets operating on a portion of the 33-kv. system. Another General Electric set at Kokomo furnishes intercommunication over a 132-kv. line to the American Gas & Electric Company system at Marion. This makes a total of 24 sets operated on the Central Indiana Power Company and its subsidiary systems.

Intercommunication is provided with four other power companies other than those forming a part of the Central Indiana Power Company subsidiaries system, namely, the Columbia plant of the Union Gas & Electric Company at Cincinnati; the Deer Creek substation of the American Gas & Electric Company system at Marion, Ind.; the Indiana Hydro-Electric Power Company at Monticello, Ind., and the Illinois Power & Light Corporation at Danville, Ill.

The Central Indiana Power Company subsidiaries system is operated from a central dispatching point located in the Lenore substation south of Indianapolis. The equipment, operating upon two frequencies, gives true

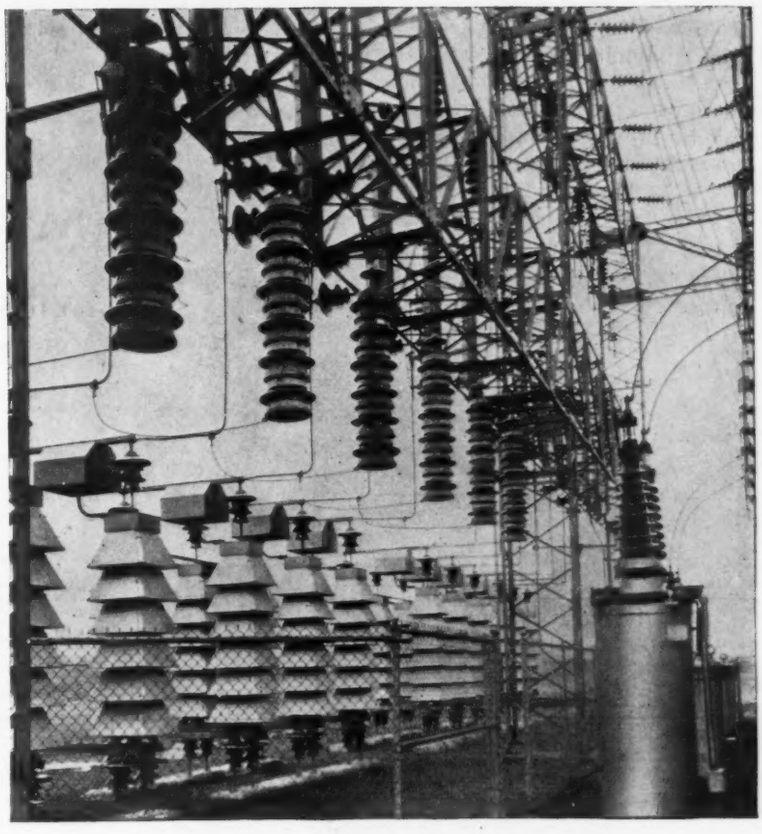


Eight duplex channels on this carrier system

(1) 66-kv. loop Lenore-Greencastle-Dresser plant-Clinton - Danville - Covington - Attica - Lafayette - Oakdale-Kokomo-Noblesville; (2) 132-kv. line Lenore-Dresser plant; (3) 132-kv. line Lenore-Greensburg-Columbia plant; (4) 33-kv. line Greencastle-Spencer; (5) 66-kv. line Dresser plant-Sullivan; (6) 66-kv. line Kokomo-Wabash-Huntington; (7) 33-kv. line Logansport-Rochester-Plymouth-Wabash; (8) 132-kv. line Kokomo-Marion.

By B. H. LYBROOK

Chief Operating Engineer
Central Indiana Power Utility Group



Suspension couplings for carrier system

This method of mounting eliminates the concrete pedestals and structural steel frameworks required for other types. These capacitors are made in 11-kv. and 22-kv. units. Six 66-kv. couplings, each composed of six 11-kv. units, are located at Kokomo.

duplex operation; that is, parties may talk to each other just as in the ordinary telephone system. The method of providing duplex operation is by the use of two frequencies, one for transmission and the other for reception, thus rendering these two functions entirely independent of each other. Although it has been stated by some persons that two frequencies limit the number of channels possible, it has been found that no such limitation actually exists in practical application. This is based upon the fact that although two-frequency power line communication sets cover practically the entire power system of the Central Indiana Power Company subsidiaries there has not been experienced any limitations due to lack of channels caused by the use of two frequencies. The use of two frequencies per channel allows stable operation with 250-watt transmitters. Adequate transmitting power is the fundamental requirement for a reliable power line communication system.

The earlier installations were coupled to the power lines by means of antennas. The later installations have been coupled by means of capacitors, and it is felt that they are superior to antennas. Although properly constructed antennas are about as efficient electrically as capacitors, there are a number of physical limitations which often makes them undesirable. It has been found that snow and sleet on the antenna insulators change their high-frequency characteristics, thereby causing the signals to be lowered in value. Also the layout of the power lines in the vicinity of the stations where sets are located is such as to prevent erection of proper antennas, and capacitors are the best solution to such problems.

Operated in conjunction with the 250-watt set at Kokomo is one of the first high-frequency supervisory control equipments. The 66-kv. line between Kokomo and Lenore loops through an intermediate substation at Tipton, some 20 miles south of Kokomo. Two circuit breakers at this intermediate substation allow the town of Tipton to be fed either from Kokomo or Lenore, thereby insuring continuous service with power from either one of two sources. The transmitter at Kokomo is provided with a wave-change switch, whereby its frequency can be changed from its normal communication frequency to the one used for control purposes. A special receiver and transmitter are used at Tipton. At Kokomo the operator has a pair of red and green indicating lamps for each breaker controlled, the indications being controlled by the position of the breakers through the medium of the special transmitter at Tipton. The use of this system eliminates the need for operators at Tipton and at the same time allows it to be promptly controlled whenever switching is found necessary at that point.

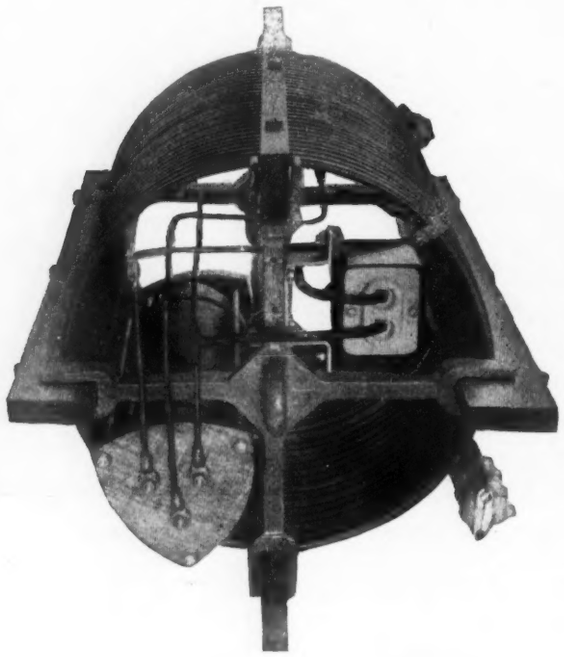
Operates when other channels fail

Operating experience with power line communication indicates that it has a number of special advantages over the usual wire line telephone system. The communication circuit is as strong mechanically as the power line itself. Wind and sleet storms severe enough to carry away telephone lines seldom do great harm to power lines because of their sturdy mechanical construction. The omission of the usual privately owned power company telephone system, together with the elimination of its initial cost and maintenance, is also desirable from an economic standpoint.

The district served by the Central Indiana Power Company subsidiaries is subject to severe wind, sleet and thunderstorms during certain periods of the year. There have been a number of cases where with all other forms of communication entirely interrupted for many hours due to such storms the Central Indiana Power Company subsidiaries system was operated without interruption by means of its power line communication system. There were several cases where all means of wire line com-

munication were paralyzed for periods of time lasting from two to three days, during which time the power line communication gave continuous service. It is during such times when inevitable emergencies arise in the operation of a power system that reliable communication directly prevents service interruptions and large financial losses by allowing efficient dispatching of the power system.

Therefore a reliable communication system, in many cases, actually more than pays for itself. Thus the fundamental requirement for the power line communication system which justifies its use over the available forms of wire line communication is reliability.



Tuned resonant chokes limit carrier channels

The tuning equipment is mounted inside of the helix. No energy is absorbed at power frequency. The chokes are used to block off those lines which interfere with communication. They are installed at Kokomo to isolate channel 1 from channel 6, and at Noblesville to overcome the drainage of carrier currents into the 66-kv. loop to New Castle. One choke is placed in each phase of the lines blocked and tuned to block channel 1 frequencies of 42 and 59 kc. These chokes, which are located as shown on the map, have given satisfactory results.

With regard to maintenance there are at present three men who are responsible for the maintenance of equipment. In general, the maintenance consists of routine testing, adjustment and inspection. The operators in the various stations where sets are installed are given instructions in making minor repairs and adjustments so that it is not necessary to send out a special man to correct minor troubles. It is believed that properly instructing the operating personnel will reduce materially the operating expense.

The power line communication system is exclusively used for dispatching purposes, since the amount of traffic handled takes up all of the available time, thus precluding its use for transacting commercial company business. In conclusion, based upon operating experience of almost six years, it is believed that power line communication furnishes a degree of reliable communication which has resulted in a continuity of power service not possible by any other form of available communication for the same cost.

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Making Bridge Measurements with High Voltage

By FRANK E. REEVES

Standardizing and Testing Department,
Edison Electric Illuminating Company of Boston

CONSIDERABLE trouble has been experienced in the past in locating certain types of cable faults due to the difficulty in picking up or holding these faults with the low voltage necessary to practically all present-day fault-locating equipment. Paraffin or oil-insulated joints, joints with sleeves cracked or burned so as to give constant access to water and cable with the lead open under water are the most common of these faults which invariably give trouble.

When an appreciable current (50 milliamperes or more) can be passed through a fault with a kenotron cable test set, even though the voltage necessary to pass this current is of the order of 30 or 40 kv., a bridge measurement can be made with the ordinary portable power bridge. It is not essential that the fault current be steady, as approximate measurements can be made with an intermittent current having a period of one second or more. In making a measurement of this sort it is necessary to make trial settings of the bridge, watching the direction of motion of the galvanometer needle each time the fault current flows.

If a current of 0.1 amp. or more with a period of about 0.1 second can be passed through the fault a fairly precise measurement can be made.

It is, of course, necessary to insulate the bridge, leads to cable conductors and jumpers (on the remote end of the cable) from ground and to exercise reasonable precaution in handling the bridge. In cases where the voltage is high, a switch-stick can be used to move the slider to a point where the galvanometer shows a balanced condition.

After the measurement is made, the fault can nearly always be definitely located by inspecting the manholes in the vicinity of the calculated location, with fault current flowing. When a fault is not solid, it can ordinarily be detected by noise, smoke, steam, air bubles in water, or a discoloration of water in the manhole. Intermittent fault current from a kenotron set makes a sharp hammering sound at the fault that cannot be mistaken.

The Boston Edison company has made successful bridge measurements using the kenotron sets on several faults, two of which were made at about 30,000 volts with intermittent fault current. The greatest error was 512 ft., in a cable whose total length was 27,270 ft. In two cases only one manhole was opened. One of these cables was 64,770 ft. in length, having a total of 219 manholes, and the other 56,790 ft. long with 158 manholes.

21 Ground Chains Tested for Safety

By ROYCE E. JOHNSON

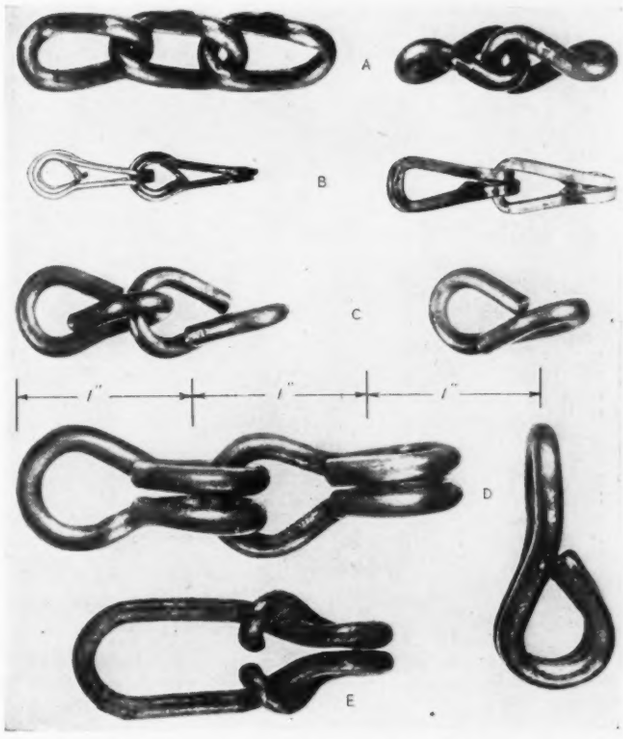
Director Electrical Standards Laboratory, University of Wisconsin, Madison, Wis.

IT IS a rather startling, and it might be a fatal, discovery to those who have been in the habit of nonchalantly using ground chains to discover that an ordinary chain, such as used by linemen on transmission lines, may be nearly as good an insulator when dry as the insulators on a 2,300-volt line. That ground chains are quite often good insulators is demonstrated by tests which have been made on 21 typical ground chains, representing five different types, during the last two years in the electrical testing laboratory of the University of Wisconsin. These tests indicate very decidedly that at least one type of chain may often be found to be a good insulator.

EXTENSIVE tests of various grounding chains have been made primarily to determine their "breakdown voltage" or voltage at which conduction starts, and incidentally to ascertain their resistances after current starts. The types of chains tested are illustrated, and brief descriptions thereof are given in Table I. It will be noted (in the right-hand column of Table I) that only one chain, No. 9, was in extremely bad condition initially. Chain No. 21 was the only other chain which had a really unsatisfactory appearance initially. From a casual inspection of chain No. 2 one would have said that it certainly would not take much voltage to start a current through it. In fact, this chain was inspected by a number of utility engineers who declared they could see nothing unusual about it.

Ordinarily the chains were tested in sections 10 ft. long, but other test lengths were used when it was expedient to do so. Detailed information regarding the length of sections and the tensions is contained in the accompanying tables. Voltage was supplied from an induction regulator and step-up transformers. The voltage was increased slowly enough so that it would begin to drop as soon as conduction current started to flow in the chain.

Tension was applied by means of cast-iron weights. One end of a section to be tested was secured to a post, while the other end was fastened to a sash cord which ran over a pulley and carried the weights. The section under test was held in a horizontal position, so all points of it were under very nearly the same tension. No particular care was taken to avoid disturbing any insulating film which may have been on the chains when they were received. The chains were untied, uncoiled and stretched out for test without giving any attention to the manner in which they were handled. Contact at the ends of the section under test with the voltage supply circuit was



Links showing the types of chains tested

A—Links from chain No. 14
B—Links from chain No. 15
C—Links from chain No. 19
D—Links from chain No. 18
E—Links from chain No. 21

TABLE I—DESCRIPTION OF CHAINS TESTED

Chain No.	Type of Link and Material	Length of Chain (Ft.)	Dimensions of Cross Section of Link Wire (Diameter), (In.)	Finish of Link	Condition of Chain
1	Welded; steel	50	0.137	Copper plate	Good, clean, used.
2	Welded; steel	50	0.137	Copper plate	Fair, slightly oxidized between links.
3	Welded; steel	50	0.137	Copper plate	Good, slightly oxidized
4	Welded; steel	50	0.136	Copper plate	Good, slightly sticky and greasy
5	Welded; steel	25	0.137	Copper plate	Good, slightly sticky and greasy
6	Welded; steel	20	0.153	Thick cu. plate	Very clean.
7	Welded; steel	50	0.137	Copper plate	Very clean.
8	Welded; steel	33	0.137	Copper plate	Very dark surface; evidently due to overheating.
9	Welded; steel	20	0.140	Very rusty	Surface badly pitted and covered with iron rust scale.
10	Welded; steel	50	0.137	Copper plate	Appeared worse than No. 2; copper plate was scaling off.
11	Welded; steel	50	0.136	Copper plate	Good, clean, not oxidized.
12	Welded; steel	50	0.136	Copper plate	Good, clean, not oxidized.
13	Welded; steel	50	0.137	Copper plate	Good, clean, slightly oxidized.
14	Welded; steel	100	0.136	Copper plate	Good, clean, slightly oxidized.
15	Unwelded; brass wire	100	0.035 x 0.090 rectangular	Natural brass	New, clean.
16	Unwelded; brass wire	50	0.034 x 0.079 rectangular	Natural brass	Used, clean, good.
17	Unwelded; brass wire	100	0.035 x 0.070 rectangular	Natural brass	Used, clean, good.
18	Unwelded; copper clad steel	25	0.162	Copper	New and clean.
19	Unwelded; copper clad steel	25	0.128	Copper	New and clean.
20	Unwelded; iron wire	23	0.141	Galvanized	Good, used; galvanizing dark.
21	Unwelded; iron wire	20	0.141	Galvanized	Very sticky, full of paint spots, galvanizing very dark and missing in patches.

secured by means of clamps. The voltmeter leads were connected directly to the chain links to which the voltage supply wires were clamped. Any voltage drop due to the contact between the chains and the supply circuit was thereby eliminated.

Nature of results obtained

Data on voltages necessary to start conduction currents flowing through certain sections of the chains are included in Table II. It will be noted that no relation is evident between tension and breakdown voltage. There is a question as to the possibility of ever establishing a very definite relation when the chains vary as much from one section to the next as these did. For instance, one section of No. 4 broke down under only 30 lb. tension at a lower voltage than another section under 80 lb. tension. The same thing is true of several of the other chains. One observation is noteworthy, however. It is that tensions as high as 80 lb. do not necessarily make a ground chain a good conductor.

Table II—Ground Chain Breakdown Voltages

	Breakdown Voltages — Minimum			Breakdown Voltages — Maximum		
Chain No.	Pounds Tension	Length of Section Tested, Feet	Breakdown Volts	Pounds Tension	Length of Section Tested, Feet	Breakdown Volts
1	30	10	780	55	25	2,600
2 (*a*)	55	0.5*	360	55	0.5*	450
2 (*b*)	55	0.5	1,440	55	0.5	2,260
2 (*c*)	30	5	2,480	30	5	5,850
3	30	10	265	30	10	1,280
4	30	10	400	80	10	3,100
5	30	10	65	30	15	93
6	30	10	0	30	10	0
7	30	10	2	5	10	25
8	30	10	440	5	13	2,820
9	30	9	15,800	30	11	19,400
10	30	10	30	30	10	150
11	30	10	20	30	10	260
12	30	10	110	30	10	560
13	30	10	500	80	10	2,050
14	30	10	0	30	10	540
15	30	25	0	30	25	0
16	30	25	0	30	25	0
17	30	25	below 0.5	30	25	below 1
18	5	10	0	5	10	0
18 (*d*)	30	10	0	30	10	13
19	5	10	0	5	10	0
19 (*d*)	30	5	0	30	10	1,240
20	30	10	0	30	10	0
21	5	10	0	30	10	0

*Inches.

(*a*) This row of data refers to four tests on single joints picked at random.

(*b*) This row of data refers to seven 6-in. sections of chain that were picked at random.

(*c*) This row of data refers to three 5-ft. sections of the chain. The third section broke down at 4,540 volts, but it was being continually twisted back and forth through an angle of about 60 deg. while the voltage was being applied.

(*d*) These rows of data were taken seventeen months after the initial test had been made on these chains. Immediately after the initial test these chains were heated to redness and subsequently they were buried in the ground over winter. They were not washed after removal.

Chain No. 2 is an excellent example of how good an insulator a chain may be and still appear to be in good condition. A typical link for this chain is shown. There were several small areas of oxide on its surface which were scarcely visible, but which were accentuated slightly in the photo-enlarging process. Tests between adjacent links on this chain under a tension of 55 lb. showed that where only one joint was involved a potential difference of 450 volts was required to break down the insulating films on the two surfaces in contact with each other.

A test on one 5-ft. section of chain No. 2 (footnote (*c*) of Table II) indicated that the film was quite resistant to abrasion. The section under test was twisted back and forth through an angle of about 60 per cent while the voltage was being applied, and not until the voltage reached 4,540 did current start to flow. The tension on this section was the same as on the section which failed at 2,840 volts.

Chain No. 9 was so badly rusted that no trace of its original copper finish was noticeable. The test results on this chain speak for themselves.

Fourteen of the chains tested were of the copper-plated welded-steel-link type and a good percentage of these required a considerable voltage to start current flowing in at least one section. The other types of chains were very much better. Only one section of one of them (No. 19) required an appreciable voltage to start current flowing. This chain had been intentionally quite badly oxidized and otherwise mistreated as described in footnote (*d*) of Table II. It is to be noted that the galvanized chains were all right electrically in spite of the fact that the galvanizing was very dark.

It is not safe, however, to draw definite conclusions

concerning the electrical properties of these types of chains from only two or three tests, even when the theoretically probable effect of the materials used in the chains is taken into account.

Data on the current-carrying capacity and resistance of the best, poorest and typical chains of the copper-plated welded-steel-link type and also of several of the other chains are given in Table III. A typical copper-plated chain (No. 1) was tested to destruction. After the chain had carried 240 amp. under 30 lb. tension a few minutes the links elongated considerably and partially fused together, making the chain rigid when it cooled. Chains Nos. 18 and 19 also were tested at high current, but the links merely opened up in these chains and were not fused together or even damaged. The chains were easily put together again by closing the links. Chain No. 18 without a doubt exceeds the others in current-carrying capacity. It carried 300 amp. for ten minutes immediately after having carried 200 amp. for fourteen minutes, and even then was not ready to break. Chain No. 19, being made of smaller wire, parted on 150 amp. within a few minutes of application.

Table III—Current-Carrying Capacity of Ground Chains

Chain No.	Length of Section Tested, Feet	Tension (Lb.)	Current (Amp.)*	Time (Min.)	Resistance in Ohms per Foot	Remarks
1	10	30	3	0	7.3	Current started
			5	2	3.5	Current increased to 5
			5	3	3.0	Chain about 200 deg. F.
			30	4.5	0.3	Chain very hot, but not red
			65	0.7	0.15	Chain very hot, but not red
1	8	30	200	0	.....	Current started
			200	1	0.017	Chain red hot in spots
			200	2.5	0.025	Chain nearly white hot
			240	5	0.027	Current increased to 240
			240	15.5	0.031	Chain broke in two places
3	10	55	5	0	1.3	Current started
				1	1.4	Chain about 200 deg. F.
6	10	30	10	0	0.009	Current started
				2	0.0096	Slight temperature rise
7	10	5	5	0	0.6	Current started
		30	5	1.2	0.36	Hot in spots; tension increased
9	9	30	0.6	0	114.0	Current started
			.....	1	97.0	Too hot to grasp
			1.0	1.3	60.0	Current increased
			1.0	3	55.0	.....
15	50	30	10	0	0.0065	Current started
		55	10	0.5	0.0057	Tension increased
		80	10	1.0	0.0052	Tension increased
						No heating on 10 amp.
17	50	5	10	0	0.0236	Current started
			.....	1	0.0234	Slightly warm
18	10	5	75	0	0.00120	Current started
		30	75	2.5	0.00113	Tension increased
		80	75	3.5	0.00096	Tension increased
		30	75	4.00	0.00100	Tension decreased. Chain slightly warm
	10	30	100	0	0.00100	Current started
			150	3	0.00105	Current increased
			200	9	0.00120	Current increased
				13	0.00135	Chain turning dark
			300	23	0.00155	Current increased
			400	34	0.00195	Current increased
				35	0.00227	Chain dull red
				37	0.00252	Medium red. Links opening
19	10	5	20	0	0.0133	Current started
		30	20	1	0.0088	Tension increased
		55	20	1.7	0.0060	Tension increased
		80	20	2.3	0.0044	Tension increased
						Chain slightly warm
	5	5	40	0	0.21	Current started
		30	40	1	0.0166	Tension increased
		30	100	2	0.0106	Current increased
		30	100	5	0.0068	.....
		30	150	5.5	0.0073	Current increased
		30	150	8	0.0095	Dull red heat
		30	150	10	.....	Chain broke
20	10	30	10	0	0.0256	Current started
		80	10	1	0.022	Tension increased
		30	10	1.8	0.025	Tension increased
		30	10	7	.....	Chain barely warm

*The currents in this column were quickly changed from one value to the next at the elapsed time indicated in the adjacent column to the right.

The manner in which the resistance of the copper-plated chains varied with increasing temperature is quite evident from the data in Table III. At first the resistance decreased very materially.

After the resistance of the insulating films was reduced to a very small value by the increasing temperature the effects of the increasing resistance due to the positive temperature coefficient of the chain material became noticeable.

Chain No. 2. Note the rust pits

The effect of temperature variation in changing the resistance of those chains which had high breakdown voltages was so great that no relation between chain tension and resistance after current started could be obtained. Those chains which were in good condition and had a low enough resistance to keep them from heating on small currents could be tested under different tensions, and if they were thus tested they furnished consistent results. Such tests are tabulated in Table III for chains Nos. 15, 18, 19 and 20.

Oxide films insulate sections

Evidently the insulating property of the chains resulted from a thin layer of iron oxide that was deposited on the chain links. That the oxide film was responsible is indicated by the following observations: (1) Washing the chains with neutral or alkaline agents which would remove grease and dirt did not noticeably, if at all, lower the breakdown voltage; (2) washing the chains in a very dilute sulphuric acid which removed the iron oxide brought the breakdown voltage practically to zero, and (3) the resistance characteristics of the chains having an initially high resistance are similar to those of iron

oxide in that the temperature coefficient is decidedly negative.

From electrochemical considerations one would expect a considerable amount of ferric oxide to form on copper-plated chains.

The copper-plated welded-link chains seem to have a thinner layer of copper between the links than on the other parts. This copper soon wears off and when the iron is exposed to moisture in the presence of the remaining copper a short-circuited voltaic cell exists in which the iron is removed by electrolytic action and some of it is deposited in the form of ferric oxide on the chain link. A deposit of ferric oxide on the chain accelerates the corroding action because the oxide as well as the copper is electronegative to iron. Even if the copper were not worn off, iron oxide would be deposited around the microscopic pores which exist in a thin layer of copper when it is deposited on iron, and eventually the chain would be more or less coated with a thin layer of ferric oxide.

Iron oxide cannot be deposited on chains similar to those numbered 15, 16 and 17, and it can be deposited only at the ends of the wire used in making the links in chains similar to Nos. 18 and 19. Copper oxide, which also is a good insulator, can form on these chains, but it will not ordinarily form in quantities sufficient to cause high breakdown voltages unless the chains are overheated or abused in some other way.

The galvanized chains will not be subject to appreciable iron oxide formations so long as a reasonable amount of zinc is left. High resistance zinc compounds, however, which were not evident on the two chains tested, may possibly be formed under certain conditions and be deposited on the chain.

Apparently there is only one metal which will produce an untarnished surface at reasonable cost, and that is chromium. Chromium-plated ground chains may cause the uninformed public to think that line crews are becoming unnecessarily artistic or refined, but if they can be produced in the welded-link style at a reasonable cost and with a non-porous surface which will prevent corrosion of the iron they would be much more satisfactory than any of the chains tested. An alternative would be to make the chains of rust-proof steel or other metal.

Copper cables best

The conclusions which can be drawn from these tests are: (1) Iron chains with a thin coating of copper are very hazardous and (2) tensions as high as 80 lb. do not insure the safeness of many chains. Generalizing from these specific statements and from a few ideas as to the things which may happen to a loose-jointed conductor such as a chain, one cannot help but decide that there is no flexible temporary grounding device which is safer than a copper cable with suitable clamps.

*ACKNOWLEDGMENT—The writer desires to express his appreciation of the splendid co-operation furnished by several members of the Wisconsin Utilities Association, without whose assistance in furnishing chains the tests would not have been possible.

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Truck Transports 112-Ton Transformers

A BRITISH road transport undertaking (Marston's Road Services, Ltd., Liverpool) has recently had a novel type of machinery transporter constructed for the conveyance of transformers weighing up to 112 tons. The truck has fourteen wheels and the power unit develops 80 hp. The normal maximum speed with a load of 73 tons is from 6 to 7 m.p.h. Given a fair road surface, the truck is capable of negotiating a 1:10 grade. The wheels at the rear swivel on a vertical axis controlled by the man riding at the back of the carrier. The special girders enable the transformers to be carried as low as possible and only bridges restrict the height of the equipment which may be transported.

To demonstrate the bulk which can be carried, one of these transporters recently carried a tugboat, 70 ft. in length, 14 ft. wide and 9 ft. deep, from one end of the United Kingdom to the other. Another important job intrusted to this truck was the transporting of a 108-ton steel bridge from Glasgow to Liverpool. Large boilers have also been successfully transported on it.

What Price Surplus Energy?

By PAUL McMICHAEL

Chemical Engineer, New York

ELIMINATION of short-period load fluctuations and an increase in the use factor of power station equipment depends upon the disposal of surplus energy. This surplus energy can be generated at approximately fuel cost if the firm energy is charged with normal investment and operating charges. The author of this paper shows how to arrive at the economic value of surplus energy under several conditions of operation.

A LARGE part of the problem, however, is to find ways to use the surplus energy. This may be possible in certain localities and is worthy of study.

THE sale of surplus electric energy at a price no greater than the cost of fuel required for its generation will yield a substantial profit.

This statement is predicated upon the determination of the net cost of generating surplus energy during off-peak periods in an efficiently operated base-load, pulverized-coal-fired, steam-generating station with an installed capacity in excess of 100,000 kw. The study was based upon actual operation results obtained in the calendar year ended July 31, 1928, during which the aggregate of energy generated was 522,917,400 kw.-hr. It was assumed that:

1. An outlet could have been developed for off-peak surplus energy if, when, and as it might have been available at a price in excess of the net increment cost of its generation.
2. All fixed charges would have been absorbed by the energy generated to supply firm demand, so that any surplus would have been free from charges on this account.
3. The quantities of surplus off-peak energy to be considered would be those amounts in excess of the actual production that would have been generated if the station had been operated continuously at rates never less than 60, 70, and 80 per cent, respectively, of its installed capacity.

Under these conditions the gross increment cost of generating surplus off-peak energy is the aggregate of the following items:

1. The additional operation and maintenance expenses incurred.
2. The cost of the additional coal required to generate the surplus energy.
3. Interest on the additional operation and maintenance expenses.
4. Interest and depletion on the additional coal required.
5. Interest and depletion on any additional quantities of stores and miscellaneous supplies carried in stock on account of the surplus energy generated.

Data from operating plant

Daily and monthly reports of station operation supplied the data for exact determinations of the yearly average number of heat units required and the weight of coal consumed per kilowatt-hour generated. The quantities of coal that would have been consumed in the generation of the different surpluses were calculated on the same basis, no credit being taken for the higher operating efficiencies that would have resulted from higher capacity use factors of generating equipment when the station operated at a constant rate. The quantities of surplus energy that would have been generated in the three cases studied and the quantities of coal that would have been required therefore are given in Table II.

Interest and depletion charges that would have been incurred by the generation of the different surpluses are shown in Table I. It was assumed that the additional operation and maintenance expenses would have been carried by the company operating the station for an average period of 60 days at a cost of 6 per cent. Similarly, it was assumed that the additional coal required to generate the surpluses would have been stocked for an average of 60 days at a cost of 6 per cent, and that the depletion of the coal would have aggregated one-half of 1 per cent of the total cost of coal consumed during the year in generating the surplus.

Even if the station had been operated at its full rated capacity throughout the year no more stores and miscellaneous supplies would have been required than actually were stocked, so that there would have been no charges for interest and depletion on this account for any surplus energy that might have been generated. The average value of the items actually carried in stock was approximately $125,000.

TABLE I—ADDITIONAL EXPENSES INCURRED BY THE GENERATION OF SURPLUS ENERGY AND THE GROSS COST PER KILOWATT-HOUR WITH DIFFERENT LOADS

	If Plant Had Been Operated Continuously Never Less Than Indicated Per Cent of Its Rated Capacity		
	60 Per Cent	70 Per Cent	80 Per Cent
Operation and maintenance	$2,592.65	$4,555.00	$7,058.86
Coal at $4.50 per net ton	197,622.00	335,061.00	510,430.50
Interest and depletion	2,990.26	5,071.47	7,727.05
Total additional expense	$203,204.91	$344,687.47	$525,216.41
Surplus energy generated, kilowatt-hours	86,425,500	146,532,400	223,226,900
Gross Cost per Kilowatt-Hour of Surplus			
Operation and maintenance, mills	0.030	0.031	0.032
Interest and depletion, mills	0.035	0.035	0.035
Total added expense exclusive of coal, mills	0.065	0.066	0.067
Cost of coal at $4.50 per ton, mills	2.286	2.286	2.286
Gross cost per kilowatt-hour, mills	2.351	2.352	2.353
Gross cost per kilowatt-hour of energy available for sale (94 per cent), mills	2.501	2.502	2.503

In Table I are shown the total additional expense that would have been incurred by the generation of the different surpluses and the cost per kilowatt-hour for each item. The total added cost, exclusive of coal, would not have exceeded 0.067 mill per kilowatt-hour and the cost of fuel, with coal at $4.50 per net ton, would have constituted more than 97 per cent of the total cost of generating the surplus energy.

It is of interest to know what would have been the cost with coal at different prices, all other conditions remaining constant. It was found that for every increase or decrease of 50 cents per ton the cost of generation would have changed 0.258 mill per kilowatt-hour. Thus with coal at $2.50 a ton the cost would have been 1.319 mills, the fuel constituting 96.26 per cent of the total; with coal at $3.50 the cost would have been 1.835 mills, fuel being 96.89 per cent of the total, and with coal at $5 the cost would have been 2.609 mills, with fuel 97.33 per cent of the total.

During the calendar year studied it was found that plant auxiliaries consumed almost 6 per cent of the total energy generated. It was assumed that the same proportion of any surplus that might have been generated would have been similarly consumed, so that the total gross cost of any surplus that might have been available for sale would have been 2.5 mills with coal at $4.50 per net ton.

The capacity use factor of the station during the calendar year studied was 56.7 per cent. If operation had been at rates never less than 60 per cent, 70 per cent, and 80 per cent of the capacity, then the corresponding capacity use factors would have been 66.1 per cent, 72.6 per cent, and 80.9 per cent respectively.

In order to determine what would have been the net increment cost of generating the surplus energy that would have been available for sale if the station had been operated continuously never less than these rates, it was necessary to evaluate the increased efficiency with which all energy, both firm and surplus, would have been generated. There was considerable divergence of opinion among the engineers familiar with daily working conditions in the station studied as to the extent that conversion efficiencies from coal to electric energy would be increased by continuous operation never less than some predetermined rate, estimates varying from 5 per cent to more than 10 per cent. However, all agreed that resultant economies would be substantial and would increase as the constant minimum rate approached that of the station capacity.

Central station operators generally recognize that elimination of short-period load fluctuations and increases in capacity use factors of station equipment would result in considerable gains in conversion efficiencies. In this study it was assumed that consumption of surplus off-peak energy would constantly equal its availability so that short-period load fluctuations would be substantially eliminated. It was further assumed that with elimination of short-period load fluctuations and increases of capacity use factors from 56.7 per cent to 66.1 per cent, 72.6 per cent and 80.9 per cent there would be corresponding increases in conversion efficiencies of

TABLE II—NET COST OF SURPLUS ENERGY GENERATED AND OF THE 94 PER CENT AVAILABLE FOR SALE

	If Plant Had Been Operated Continuously Never Less Than Indicated Per Cent of Its Rated Capacity		
	60 Per Cent	70 Per Cent	80 Per Cent
Coal required to generate surplus energy, tons	43,916	74,458	113,429
Coal consumed during year, tons	265,712	265,712	265,712
Total required—basis actual operation, tons	309,628	340,170	379,141
Estimate of increased efficiency, per cent	2.0	3.5	5.0
Saving effected in coal consumed, tons	6,192.56	11,905.95	18,957.05
Value of coal saved at $4.50 per ton	$27,866.52	$53,576.78	$85,306.73
Gross cost of surplus, basis actual operation, Table I	$203,204.91	$344,687.47	$525,216.41
Gross cost less saving on coal by increased efficiency	$175,338.39	$291,110.69	$439,909.68
Surplus energy generated, kilowatt-hours	86,425,500	146,532,400	223,226,900
Net cost per kilowatt-hour of all surplus generated, mills	2.209	1.987	1.971
Net cost per kilowatt-hour of surplus available for sale (94 per cent), mills	2.159	2.114	2.097
Cost of coal per kilowatt-hour of surplus generated, mills	2.286	2.286	2.286
Cost of coal per kilowatt-hour surplus available for sale (94 per cent), mills	2.432	2.432	2.432
Net cost per kilowatt-hour in terms of fuel cost, per cent	88.8	86.9	86.2

2.0 per cent, 3.5 per cent, and 5.0 per cent respectively.

In Table II are shown the net costs per kilowatt-hour of the quantities of surplus off-peak energy that would have been available for sale if the station had been operated continuously during the year at rates never less than those indicated. From these it is seen that when the surplus is credited with the savings in the cost of generating firm energy, the net cost of the surplus is appreciably less than the cost of the fuel required for its generation.

Thus, under the conditions set forth, if the surplus energy had been sold at a price equal to the cost of fuel required for its generation, the profit to the central station would have ranged upward from 12.6 per cent to 16.0 per cent.

While the conclusions arrived at in this study are directly applicable only to the particular station whose records were examined, nevertheless it is believed that similar studies of other base-load, coal-fired, steam-generating plants would show similar results, so that central station operators might well give serious consideration to any means offered for the immediate utilization of surplus off-peak energy, if, when, and as it may be available, even at prices less than the cost of the fuel required for its generation.

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Compact, Flexible, Portable Relay Test Transformer

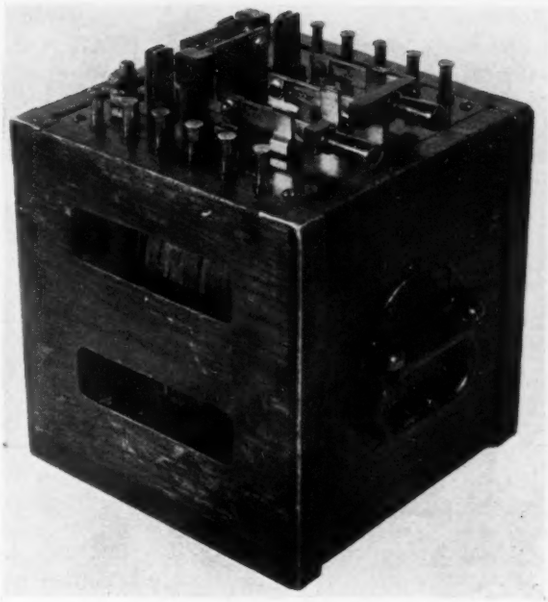
By FRED P. RHINE
Detroit Edison Company, Detroit, Mich.

WIDE variety of use is possible to the locally designed type of portable relay test transformer now used by the Detroit Edison Company. The transformer is characterized by a wide range of available voltages, its small over-all dimensions of 8 x 8¼ x 8½ in. and comparatively light weight of 34 lb.

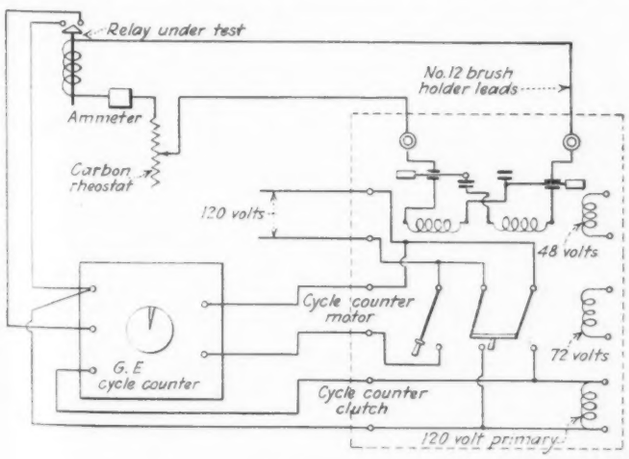
The core is cylindrical, similar to that used in a bushing type current transformer, this shape being chosen because it is of less weight and requires less space with the windings than any other core for a transformer of a given size. This design has additional advantages with respect to increased output due to the use of continuous laminated iron, and also to the improved secondary voltage regulation resulting from the thoroughly interlinked primary and secondary windings, keeping the leakage flux to a minimum.

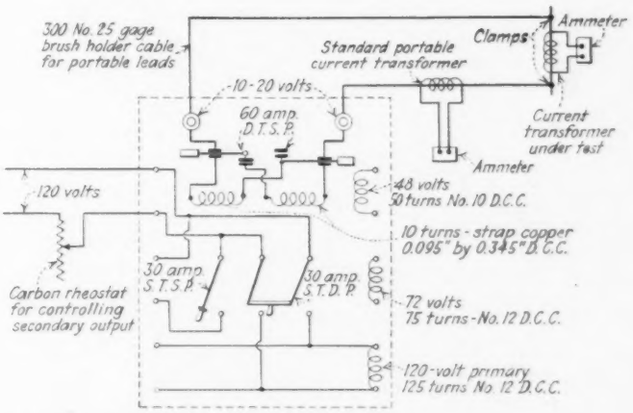
The transformer is mounted in a wood case, which is braced with ⅛-in. strap iron to give the additional strength necessary for portable equipment. Vents are provided on two sides of the case for cooling purposes. The switch panel is mounted flush with the top of the case. Sheet bakelite ⅜ in. thick was selected for the panel for its greater strength and neatness of construction in comparison with a panel made of wood.

The windings and connections are so arranged that



This relay test transformer is easy to carry around




300 No. 25 gage brush holder cable for portable leads
Standard portable current transformer
Clamps
Ammeter
10-20 volts
60 amp. D.T.S.P.
Current transformer under test
Ammeter
120 volts
48 volts 50 turns No. 10 D.C.C.
10 turns - strap copper 0.095" by 0.345" D.C.C.
30 amp. S.T.S.P.
30 amp. S.T.D.P.
Carbon rheostat for controlling secondary output
72 volts 75 turns - No. 12 D.C.C.
120-volt primary 125 turns No. 12 D.C.C.

Arrangement for testing timing relays and current transformers

After the transformer has been tested and found O.K., General Electric 3X compound is poured into the case to a depth on the bottom of ½ in. When set, the compound holds the transformer rigidly in the case.

the transformer can be used for setting relays as well as primary current testing of current transformers. Where the load impedance is low, as is the case in testing current transformers for ratio, continuity of circuits, etc., current values up to 800 amp. may be obtained from the 10-20-volt secondary coils. Experience indicates that 240 amp. is the most desirable value of current to be used in testing current transformers for the reason that this value of current is high enough for accurate testing and yet permits the demand of the 110-volt primary coil of the test transformer to be less than 30 amp., which is necessary to keep the 30-amp. fuses from blowing in the plug circuits.

The internal connections of the transformer to the knife switches have been arranged for convenience and time saving in setting up the equipment for timing relays. The 48- and 72-volt coils are necessary where timing currents of 30 amp. or more are required in setting relays of a relatively high impedance. The single-pole switch is used to open the circuit to the cycle counter motor during the time the cycle counter is not being used in the set-up. This avoids trouble with the cycle counter clutch by eliminating unnecessary wear. The two-pole knife switch serves a double purpose in that current is applied to the relay at the same instant the cycle counter starts operating.

This transformer may also be used for a variety of purposes; for example, when it is desired to obtain various testing voltages other than those of the secondary coils it is possible to connect the 10-volt, 48-volt, 72-volt and 120-volt coils in series and impress 220 volts across them. Connected as an auto-transformer, a number of different voltages may be taken from this set-up.

Ten of these transformers have been in the service of the relay testing division of this company for three years and our experience indicates that they have satisfactorily met the requirements of field testing.

▼ ▼ ▼

Power-Factor Clause Adopted by P.G.&E.

EFFECTIVE July 1, 1930, the Pacific Gas & Electric Company will make its first move to correct power factor by placing in effect a new power schedule. The power-factor clause in the new tariff reads:

"Where consumers have total connected load of 500 hp. or more, charges for energy shall be adjusted for weighted monthly average power factor in accordance with the following: If the power factor exceeds 80 per cent lagging, or is leading, bills shall be reduced by 0.3 per cent for each 1 per cent of such excess up to 90 per cent power factor inclusive, and by 0.2 per cent for each 1 per cent of such excess over 90 per cent power factor, provided that maximum reduction shall not exceed 5 per cent. If power factor is less than 65 per cent, bills shall be increased by 0.5 per cent for each 1 per cent of such deficiency in power factor provided that maximum increase shall not exceed 5 per cent. For this purpose power factor shall be computed to nearest even 1 per cent, provided, however, that in no case shall total charge be less than the minimum charge."

The wording in one place is a little obscure, but it means that if a customer has a power factor of 100 per cent or any value leading, he will receive the maximum discount of 5 per cent. Kilovolt-ampere-hours will be measured by connecting ordinary kilowatt-hour meters to measure the reactive component in conjunction with special current transformers. The ratio of kilovolt-ampere-hours to kilowatt-hours will then give the weighted power factor.

A check of the company's power customers indicates that revenue will not be appreciably affected one way or the other as penalties will offset bonuses. However, it is hoped that as time goes on customers with low power factor will so modify their installations as to be able to take advantage of the bonus.

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Safety Activities on Electrical Properties*

III—Statistical Records

INTELLIGENT direction of industrial safety work demands an accurate knowledge of accident facts. In most cases this information may best be obtained from accident records designed to show how and where accidents happen, the nature of injuries, the seriousness of accidents and the trend of the accident experience, thereby indicating the types of accident demanding the greatest consideration and the departments or divisions requiring intensive preventive effort.

Accident frequency and severity, based on million and thousand man-hours worked respectively, are commonly used for rating purposes.

In many of the organizations studied foremen or supervisors are held responsible for reporting personal injuries which occur in their respective units. This usually insures prompt and accurate statements concerning the circumstances surrounding the accidents. In other companies the reporting of accidents is considered a personal responsibility of the injured employee. One utility states:

> It is a rule of the company to report all accidents, no matter how trivial. Any infraction of this rule carries severe penalty. The employee's story of an accident is checked by the safety supervisor through witnesses. A prevention-of-accident blank is sent to the foreman, asking for some specific recommendation to prevent a recurrence of this type of accident.

Although man failure was reported by most companies as the primary cause of the majority of accidents, the lack of proper supervision was given frequently as an important contributing factor. The immediate causes of accidental injury listed by the utilities are:

Electric shock	Defective tools or equipment
Falls	Flying obstacles
Burns	Disobedience of rules
Handling tools	Falling objects

Maintenance, construction and distribution departments are commonly listed as those having the greatest number.

*See ELECTRICAL WORLD, *April 26 and May 3.*

Another Toehold for Bare Neutral

TWO THOUSAND bare-neutral installations have been operating in Evansville, Ind., for some time without any serious consequences. Now comes another recruit to the cause—Detroit. The 1930 rulings which supplement the National Electrical Code for local application in that city contain two permissive recognitions of the bare neutral. The reasons why these important concessions were made are to be found in the accompanying statement of Ben W. Clark, chief electrical inspector of Detroit.

Article 123—In a.c. single-phase systems where neutral is grounded on customers' premises service may have bare neutral.

Article 475—A.c. single-phase systems where neutral is grounded on customers' premises may be installed with bare neutral in rigid conduit by special permission in writing and under strict supervision.

THE permissions quoted above are from "Rulings Adopted by the Department of Buildings and Safety Engineering, Bureau of Electrical Inspection, city of Detroit, Mich." They indicate that the fourth largest city in the United States is going to give a trial to the bare neutral idea and that trial, according to Ben W. Clark, is going to be both comprehensive and conscientious. The first of the quoted rulings is the less important of the two because it refers to wiring of which the greater part is outside the building. It is, however, important particularly on the average range job where the service from the connection drops to the meter usually consists of three No. 8 wires. The bare neutral permits an average saving of about $4 on each installation because 1-in. conduit can now be used instead of 1¼ in., as was required by three No. 6 wires, each one insulated. The second ruling is the one which represents the greater gain to the bare neutral cause and, states Mr. Clark, "its application will be carefully administered and closely watched until the practice has indubitably demonstrated its complete safety."

"We start from the premise," said the Detroit inspector, "that the first considerations of electric wiring are safety and economy. To my mind these considerations are fulfilled by the bare neutral. But I should not want to inaugurate a practice to be used throughout the city on my single opinion, however firmly I held it. The practice must have more than my opinion behind it; it must have the experience and test of a reasonable time of trial. That is exactly the purpose of ruling No. 475—to permit certain bare neutral installations to be made; enough of them to make convincing the record of test and performance to which we intend to subject them.

"Rigid conduit is specified in this tentative ruling for two reasons. The first is that this construction is the one in which there is least possibility of mechanical damage to the conductors and thus the bare neutral is tried out under the most favorable circumstances. If it shows up well under these conditions it will be time then to consider it for other wiring methods. The second reason is that if the experiment does not prove as we expect, it will be easy—granting that the conduit is large enough, and on these first installations we will see that it is—to pull out the bare wire and at the same time draw in an insulated one. The ruling specifies written permission and strict supervision. This means that we will have an authoritative record of installations, that we will give permission only to those contractors who we think are qualified and will go along with us in the experiment

and that the inspection bureau will closely watch the work of installation.

"We intend to make tests on jobs as they are being installed and to follow them up with megger checks afterward. There has not been any arbitrary limit set on the number of bare neutral permissions that will be issued, but the number will be large enough so that the experience data will be convincing and small enough that the inspection bureau can keep good track of them. When, as I expect, we shall have accumulated a sufficient fund of favorable data we shall remove the permissive restriction from the ruling and recommend that the National Electrical Code committee recognize and sanction the practice."

Responding to a question as to what were the immediate considerations that caused Detroit to insert bare neutral rulings into its local specifications, Mr. Clark replied: "We just came to the conclusion that there had been enough arguing on this subject and that the only way for us to reach a conclusion that we could be sure was right was to go ahead and try the system for ourselves."

This question and answer appeared to start Mr. Clark to thinking about a pet idea.

Burden of permitting innovations now rests upon city bureaus

"You know," he said, "the committee of the N.F.P.A. that formulates the National Electrical Code is really like a jury. It considers the evidence placed before it and renders a verdict. It seems to me, and other men have the same idea, that the committee should be more than just a jury. Its activities should extend to the securing of evidence. As things are now the municipal inspection bureaus are forced to do all the pioneer work in connection with the introduction of inventions, new developments and improved methods into common practice in those branches of the electrical art that are concerned with the utilization of energy by the people at large. Thus it is that the local rulings, whose original conception was that they should supplement and amplify the minimum provisions of the national code as those provisions were made applicable to local conditions, have assumed a very much different responsibility. They have become the trying ground for new, sometimes radical, ideas—ideas that, without this proving, would probably never, or only with great difficulty, have any chance of acceptance into the national rules.

"But city electrical inspection bureaus are not organized and maintained at expense to taxpayers for the purpose of experimental research on developments in the electrical art. Their single duty and reason for existence is to assure the safety of electrical installations. The pioneering of new developments, of which so much has been done by them, is simply a job that has been wished on the inspection bureaus because the electrical code committee of the N.F.P.A. could not, or would not, take it.

"I should like to see this committee have under it a subcommittee that would have the duty of examining, testing and trying out new devices and methods which appear from time to time as forward steps in wiring practice. Perhaps in suggesting such a subcommittee I am like a child who wants the moon. But I know that the first step toward getting anything is to want it.

"We've talked away from the Detroit ruling on bare neutral wiring, haven't we? But maybe not so far away at that. As the inspection bureaus strike out on new paths in wiring development, assuring themselves at every step that they do not leave the firm ground of safety, just as Evansville has done and as we are doing in this matter of bare neutrals, perhaps the national committee will be tempted finally to lead instead of, as now, only to follow."

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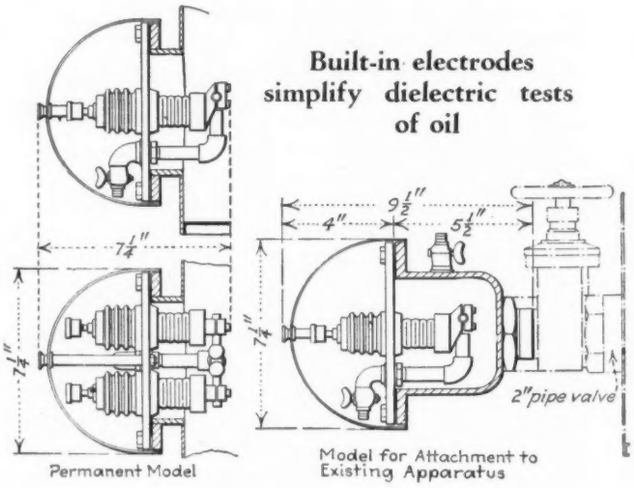
Transformer Oil Tester Built in Case

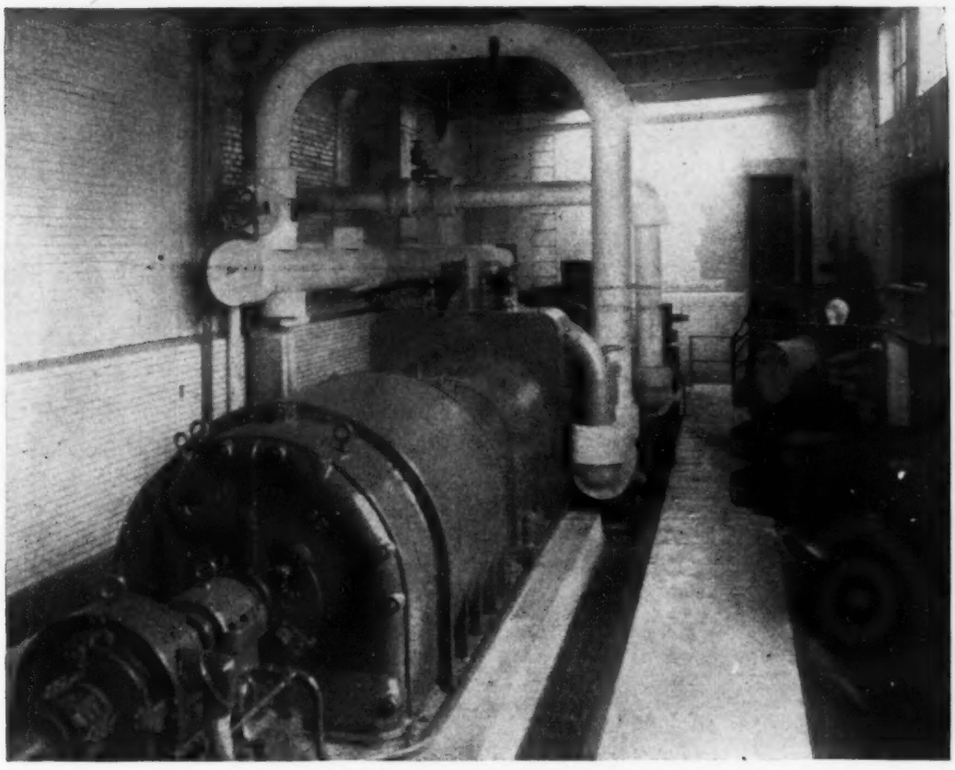
OIL is usually drawn from a small drain valve near the bottom of a transformer or switch tank into a bottle, from which the tester pours off a small amount through a funnel or a pipette into the testing vessel proper. The valve, the bottle, and the various glass utensils may not be perfectly clean. A small amount of water in the relatively inconsiderable quantity of tested oil is liable to introduce an out-of-proportion large per cent error. Yet the result of this test decides the fate of many thousands of gallons of oil.

All of these uncertainties and perhaps many others may be avoided with an arrangement, as described in the March 27 issue of the *Elektrotechnische Zeitschrift*, according to which a small, simple and inexpensive set of electrodes is built directly into each transformer as a permanent part thereof. The high-voltage testing

Built-in electrodes simplify dielectric tests of oil



transformer is then simply rolled from machine to machine to make the routine oil test. Three to six shots are taken on each unit to obtain a reliable average value. To remove carbon particles from between the electrodes after every shot, a small tube with a petcock end allows draining some of the oil at the immediate vicinity of the electrodes. The accompanying sketch illustrates this new accessory. To make its use possible also on existing transformers a special model is available which can be permanently attached to the main drain valve.



Main turbo-alternator and exciter

Electric Paper Mill Drive Saves Fuel

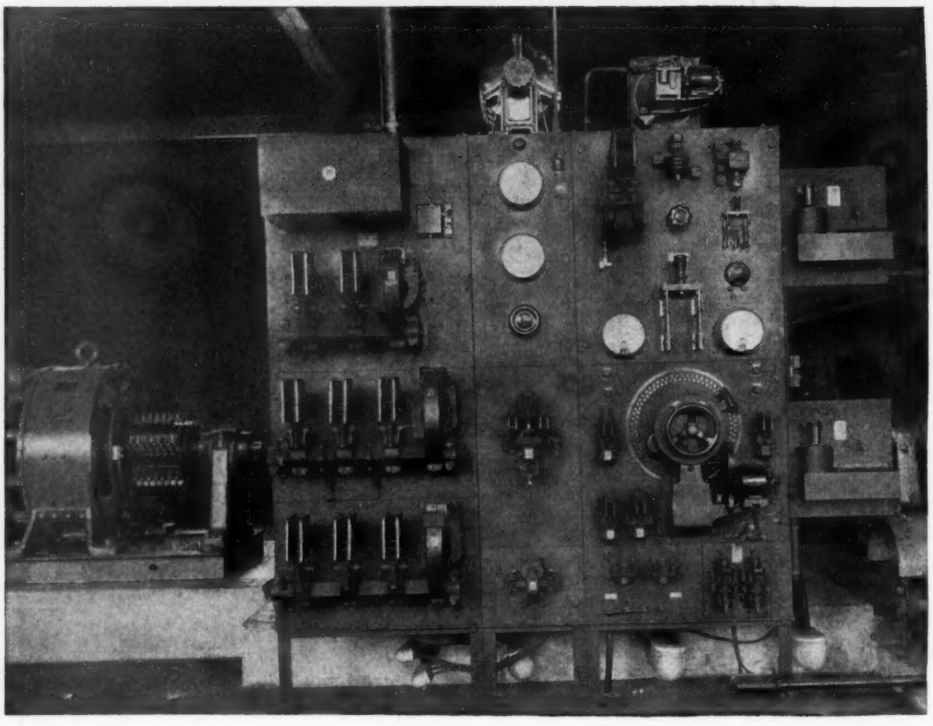
By H. D. FISHER

Plant Engineer New Haven Pulp & Board Company, New Haven, Conn.

THE employment of steam bleeding from a 400-lb., 2,000-kw. turbine has been found distinctly advantageous in a plant which manufactures the pulp board base of paper box goods. A year ago the previous turbine installation was operating condensing and the smaller engines driving the auxiliaries operated non-condensing and exhausted into the line fed also with steam bled from the main turbine. The boiler pressure was then 150 lb. per square inch and the bleeding was done from the 15-lb. stage of the turbine for some of the process steam requirements, the balance being obtained from exhaust of the auxiliaries. But the boiler installation had served many years of useful life and extensive changes were necessary from the standpoint of economy and efficiency. A thorough study was made of the steam requirements for processing of the pulp and drying the paper, a Bailey steam flow meter with a variety of orifices contributing most of the desired information. A larry scale on the coal and a feedwater meter also contributed information about the consumption requirements.

The new installation of a Westinghouse 2,000-kw. turbine operating at 400 lb. pressure reduced the fuel consumption to about 60 per cent of its former value, with plant operations at about the same level. The saving is attributable to the bleeding at comparatively high pressures from a high-pressure system and with non-condensing operation of the turbine as against bleeding at a low pressure from a comparatively low-pressure turbine in condensing operation. The present bleeding is being done at pressures which range from 70 to 90 lb. and the amount extracted ranges from 5,000 to 8,000 lb. of steam per hour. This steam is used for the older auxiliaries, small pumps and also for the higher pressure drying steam for the paper driers. The exhaust at 30 lb. back pressure varies much less in volume with changes in load on the turbo-generator than the volume of extracted steam. The exhaust steam is used for other driers and the water heaters.

If individual turbines had been employed to drive the two paper machines (92 in. and 114 in.) it probably would have been impossible to attain the desired heat



Constant speed control panel

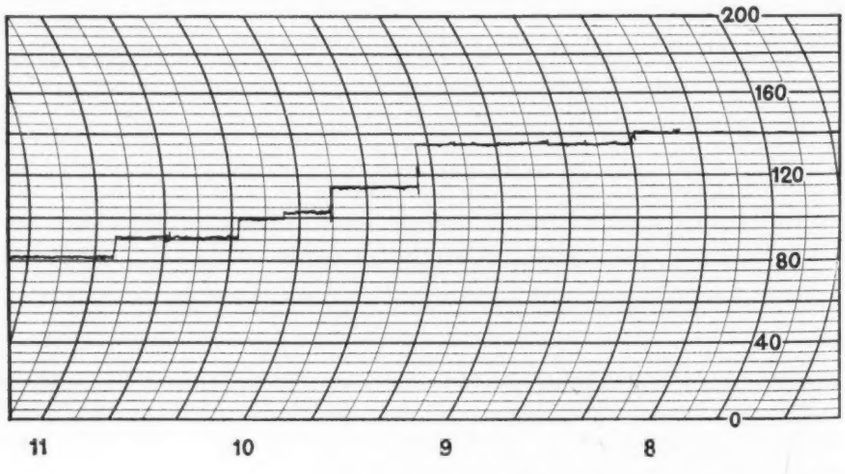
Carbon pile rheostats in inclosures at right of board, motor-generator set visible at left, pilot generator and cog-belt at right, paper machine on floor below.

balance and the steam consumption would have been enough higher to result in an excess of steam for the process requirements. Therefore it was decided to employ electric drive in order to justify a single large turbine. Each of the large paper machines is driven by a direct-current motor supplied from individual motor-generator sets. The motor of the set is a 60-cycle synchronous machine and the generator a 250-volt direct-current unit with field control through carbon pile rheostat. It is extremely important to maintain uniformity of speed in order to attain uniformity in paper thickness, the specifications in this respect becoming increasingly more exacting.

Paper machine drives may be semi-standardized

The power requirements for the two paper machines differ enough to have justified the adoption of somewhat different sizes of motor and control apparatus to apply to them. However, it was felt that interchangeability of parts would have a value offsetting any slight pecuniary advantage accruing from the more exact choice of motor ratings, consequently a 200-hp. Westinghouse direct-current motor was employed in both cases with identical motor-generator sets and field control panels. The drive is by means of cog-belt, employing fourteen individual belts in as many wedged grooves. The nominal motor speed is 1,000 r.p.m., but the pulley ratio and the speed adjustment of the motor permit adjustment to a range of shaft speeds that give linear speeds of from 240 ft. per minute to 55 ft. per minute for the paper.

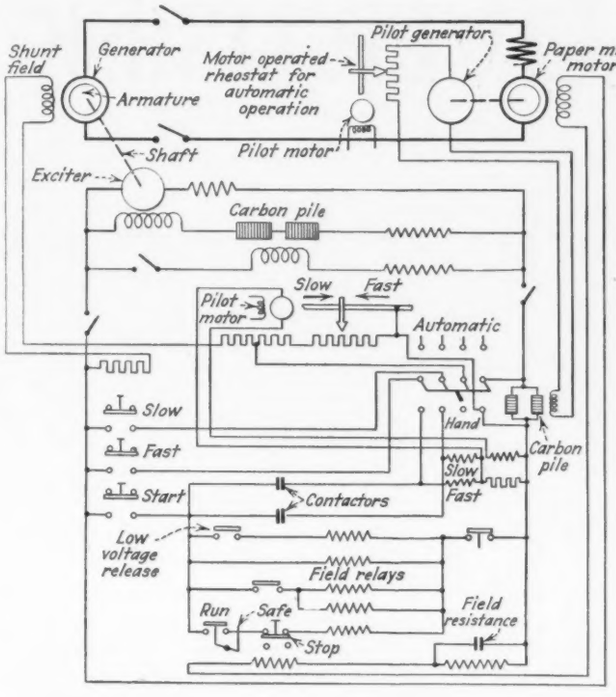
A small d.c. pilot generator, chain-driven from the paper machine shaft, energizes the armature of the solenoid in the speed control mechanism and changes the resistance of the carbon pile. When the paper speed rises above the predetermined value the voltage of the pilot generator rises, the solenoid releases the pressure on the carbon pile, increases its resistance, decreases the field current of the generator and decreases the armature voltage of the constant-field driving motor, thus reducing its speed to the desired value. Various values of speed are required for the several thicknesses of paper product and these are obtained by pushing the fast or slow buttons on the main panel, a small pilot motor changing the setting of supplementary rheostats in the generator field circuit and regulating its voltage to conformity with the desired motor speed. The resulting speed control is of the order of one-half of 1 per cent. This is not appreciably better than was obtainable with governor control on direct turbine or engine drives, the real ad-



Paper machine speeds held at fixed values

vantages of the electric drives residing in the fuel and steam economy attendant on the use of a single large turbine.

A graphic meter in the plant engineer's office shows the duration of operation at each speed and correlates the machine operation with the production requirements for the day. Of course, it also shows the extent to which



Motor regulator holds desired speed constant

Simplified diagram omits complexity of automatic control circuit, showing only circuit for hand operation. Exciter voltage constant; slow and fast buttons operate pilot motor driving contact on rheostat in generator field circuit; paper machine motor responds in speed to generator voltage; carbon pile rheostat holds speed constant at desired value.

the speeds are held at the desired constant value by the automatic speed control mechanism.

The power requirements of the constant-speed shaft of the paper machines are taken care of by 440-volt, 150-hp., 60-cycle slip-ring motors which drive line shafting to which pumps, screens, etc., are belted. The mill is completely electrified, some 90 motors aggregating 3,800 hp. The breaker-beater is driven by a 200-hp. synchronous machine. Without excessive excitation on this motor or on the synchronous motors of the motor-generator sets the plant power factor ranges from 92 to 95 per cent. The remaining motors are squirrel-cage and slip-ring, with the former in the majority.

The main turbine is rated 2,500 kva. at 80 per cent power factor, but is bladed for 2,500 kw. output under bleeding operation. In case the power requirements of the plant increase, one or two additional synchronous motors can be installed to carry the additional load and the power factor brought up to unity. This will make it possible to realize fully on the present installed kilovolt-ampere capacity and take care of an additional 500 kw. of plant load.

Indirect Lighting in the Home

By M. LUCKIESH
Director Research Laboratory, National Lamp Works, Cleveland

THE returning interest in the various degrees of indirect lighting for the home, which may become a "lighting panacea," prompts a review of the lighting principles and requirements in this field. Inasmuch as the greatest interest in furnishings and decoration usually centers around the living room, the lighting of this room is well suited for discussion. Activities in the living room vary from those quiet occasions when studying, reading and similar restive occupations are pursued to those occasions when a large and joyous company is gathered. The same kind of lighting for this room is surely not best for this variety of activities. The superiority of lighting lies in its flexibility.

A flood of light along with many sources, such as is furnished by portables and brackets, provides for the festive occasion. However, when we are spending an evening entertaining a few intimate friends, the air of festivity created by a flood of light can hardly be considered appropriate. Lighting for this occasion is suitably provided by a moderate amount of general light plus local areas of light and color. The level of general lighting need only provide for the discerning of the features of those with whom we are conversing. The inability to distinguish clearly the expressions of those conversing, a condition which is so often found today, robs one of much of the charm of conversation. On the other hand, when we wish to create a truly restful environment for reading and contemplation we usually find localized light from portable lamps most suitable. In this case our level of general lighting need only be enough to relieve excessive contrasts. This is necessary if the most comfortable condition for the eyes is to be obtained. The scope of these activities precludes the possibility of any one form of light distribution being suitable.

In the office, school and factory and all workplaces uniform general lighting is desirable, and probably cost is the factor which prevents the use of nearly uniformly lighted ceilings for producing the desired uniformity. Various proportions of indirect lighting are always helpful in creating comfortable conditions for the eyes. However, in the home, where variety and differences of brightness and color are so highly prized for the decorative and environmental effect, high proportions of indirect lighting limit the possibilities of introducing these desirable attributes of light. Some of the recently introduced indirect-lighting floor standards illustrate the case. The manufacturers' claims of being able to read or play cards in any part of the room with these devices are usually fulfilled, but, due to the unusual flood of light, most of the finer effects are immediately wiped out.

It is generally understood that climates possessing "everlasting sunshine" become monotonous and, likewise, a continuously overcast sky creates the desire for a day of sunshine. How, then, in our homes, where we have full control of the feeling of the room through its lighting, can we ignore variety and accept any one distribution of light to the exclusion of all others?

SELLING Through ADVERTISING

By HOWARD C. WILSON

President Howard C. Wilson & Associates, Hartford, Conn.

IN A convention speech to a group of public utility advertising managers a prominent executive is reported to have said, "It has been suggested that utilities increase their advertising appropriations, and I believe that many of them are of a mind to do so; however, it remains for you men to tell us how and for what the increase will be used."

It seems both fitting and proper that utility executives should want to know more about the directions in which they are going advertising-wise, and by the same token this subject seems to be something of an enigma for many of the advertising managers. The thought is well worthy of discussion, to say the least.

For a considerable time electric utility advertising has been largely of two types (1) Appliance advertising (the recital of merchandise at a price). (2) Blue sky advertising, so called (which extols electricity as a gigantic power).

Neither of the two types has any tangible effect on the mental reaction of the user. In the first division appliance advertising is based upon the premise that as more appliances are sold it must follow, as the night the day, that individual consumption of current will increase. Theoretically, this seems to be a sound hypothesis, but in actual practice it is not necessarily an axiom. One prominent utility found that its load showed no perceptible increase after a continued merchandising campaign which resulted in the sale of a goodly number of appliances. It was definitely determined, in this case at least, that the sale of the minor appliances had little or no relation to the amount of current used. It was necessary to go far deeper than that.

Isn't it reasonable to ask ourselves these questions? Why are not more homes completely electrified? Why don't people use more electricity in the homes? What are the chief resistances to increased individual usage? What is going on in the minds of the users?

At the outset, we may safely assume that we are dealing with a state of mind, a mental attitude. While the great majority of people now use electric lights exclusively, there are but very few who even consider the full use of electricity in the home. There are many homes, to be sure, using 500 kw. or more a month. These families seem to be perfectly satisfied with the service and the rates. Why are there not more of them?

Sales efforts during the past few years have made their impression in the field of washing machines, vacuum cleaners, and a few small appliances. We are, however, far distant from what might reasonably be expected of electric cooking, refrigeration, hot water heating and the thousand and one household appliances which will come into general use as soon as public opinion favors them as it has vacuum cleaners and electric irons.

Monthly bill handicaps use

Isn't it true that one of the greatest resistances to the increased individual use of electricity is the mandatory monthly bill? This jolt seems to cause lachrymal fluency about every 30 days and properly upsets the proverbial beans.

It makes mighty little difference to most people what they spend for cigarettes, soda water or gasoline in the course of a month. These things are usually paid for out of pocket at the time of purchase. How many can tell what their gasoline bill was last month? When we are out of gasoline we stop at the nearest filling station. The more we travel the more gas it takes; we laugh it off and let it go at that. There is no eerie goblin shouting the exact monthly cost. But with electricity we have it in boldface—so many dollars and so many cents every single month. If perchance the amount should be slightly higher than over a corresponding period, father has a cerebral hemorrhage, delivers a tirade in which the declamatory passages blister, sear and excoriate the family for undue carelessness with the bathroom, cellar and front porch lights. The whole family sets about to make "light chasing" the king of indoor sports. The vacuum cleaner does less "vacing," the percolator "perks" no more and is usurped by the old coffee pot, all in the interest of economy. The family slogan becomes, "use less electricity and save money." What is being done in utility advertising to influence this mental attitude? How can appliances be sold over any such resistance? We not only have the first cost to overcome but the operating cost looms up like Mars at perihelion. The family is not using the appliances it now owns, to say nothing of buying any more. And, too, this family is typical of thousands upon thousands that continue to believe that electricity is in its infancy, unreliable, costly and for the exclusive use of the rich who live on Snob Hill. Is it

not obvious that utility advertising must do its part in changing such mental attitudes before we may hope to increase the individual usage of electricity to any marked degree? To change them is not an easy thing to do, but it can be done and is being done and done successfully by a few, a very few, electric utilities today.

To mold a more favorable public opinion of the value of electricity in the home requires a carefully executed, well-focused program of advertising, not only selling appliances or extolling the powers of electricity, but describing its uses, its enjoyments. It means explaining the monthly bill in dollars and cents; not in ohms, flat rates, full use schedules, and kilowatt-hours. These terms should be eliminated from advertising copy as far as possible. Very few users know the meaning of these technical terms and do not give a whit how the engineering department functions. By and large the users of electricity are not interested in how the rate is determined or whether it is an "open covenant, openly arrived at." The big thought to get over is that electricity is inexpensive and by its full use the cost is proportionate to other expenses, whether one lives on Snob Hill or down in Frog Hollow. These ideas may be brought out with compelling force by well-executed and carefully evolved newspaper advertising and inclosures with the monthly bills. While this is a part of merchandise advertising, it is distinctly apart from it and should be focused on the specific bull's-eye of merchandising current instead of appliances. Consequently, it makes any appliance advertising that much more effective.

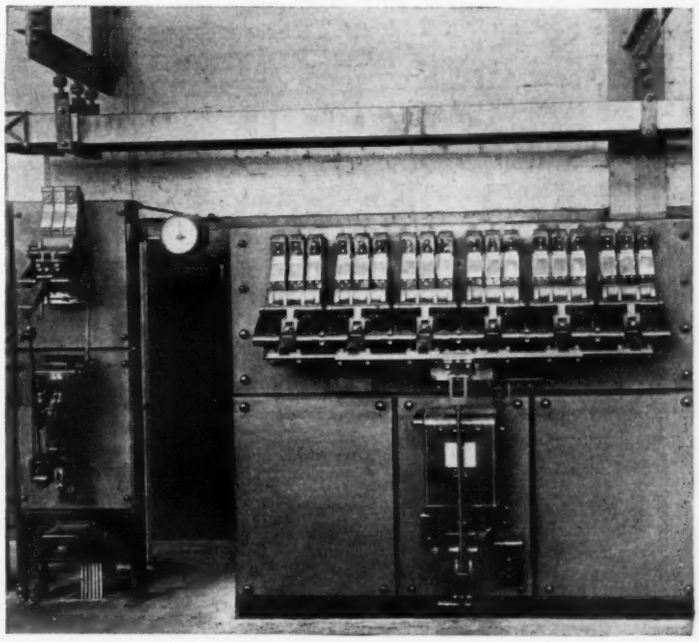
It is selling a fundamental idea and amounts to good old-fashioned testimonial advertising whenever it is possible and practical. This is best accomplished by showing actual family bills, the exact amount paid for electricity in dollars and cents and the great amount of heavy back-straining work that has been eliminated.

People like to read about people and they must be sold completely that electricity is "being done" by their neighbors; that it is cleaner, better, easier, gives more leisure time, yet costs no more than antiquated methods. Then we are ready to talk prices, terms and models with a far better chance of their being used advantageously.

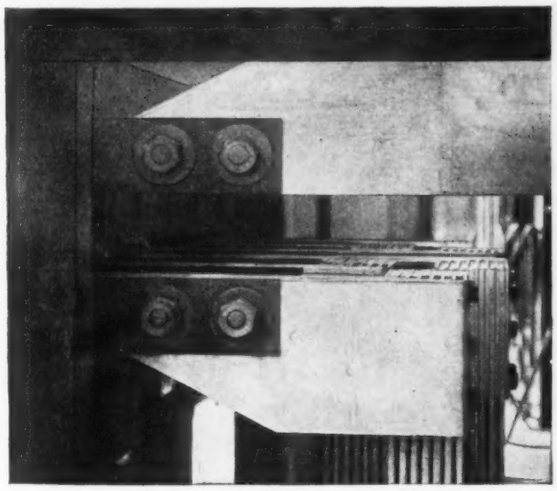
Connecting 50,000-Amp. Breaker to Aluminum Busbar

By J. ELMER HOUSLEY
Alcoa, Tenn.

SEVERAL unique design features were incorporated in the installation of a 50,000-amp., 600-volt circuit breaker recently placed in operation at the Alcoa plant of the Aluminum Company of America. Each of the six sections of the breaker, which is made by the I-T-E Circuit Breaker Company, contains three laminated bridges. A locking bar is provided for holding the breaker closed when it is desired to clean or adjust the breaker. Any one of the six sections may be opened and cleaned while the load is being carried by the others.



Multiple contacts permit cleaning or adjustment of one set while load is carried by others



Method of joining aluminum buses to breaker terminals

Each terminal of the breaker consists of 54 $\frac{1}{4}$x5-in. rectangular bars. Direct connection is made to aluminum busbars arranged with eight $\frac{1}{4}$x10-in. bars for each of the six groups per terminal. The upper terminal leads directly to the load, the lower terminal connects to a vertical riser from the common bus under the main floor of the station. The six vertical risers each contains seven $\frac{1}{2}$x6-in. aluminum bars.

Two $1\frac{1}{4}$-in. steel studs bolt up each section of the terminals of the breaker. Large steel spring washers are used to take up any expansion or contraction in the assembly and thus maintain a very high contact pressure.

Lamp Manufacturers' Response to Architect-Engineer Problems

HOW can the various professions and industries that contribute to the production of commercial and public buildings come nearer producing the best composite result? This question, which has existed for years, was discussed in the April 12 and 28 issues of ELECTRICAL WORLD. Architects, illuminating engineers, fixture manufacturers, contractors and utilities related their requirements, their problems and possible ways of securing more effective collaboration.

In what follows representatives of lamp manufacturers emphasize some facts which have either been overlooked or ignored.

H. H. MAGDSICK
National Lamp Works

Floodlighting of buildings can make them and the streets more prosperous, by giving them a character and appeal by night which cannot be obtained by day. Still, many buildings disappear in the darkness at night, when they could be made more impressive and thus bring people out of doors at night. At least one watt per square foot should be allowed for modern floodlighting.

Architects have overlooked the opportunity to adapt buildings to signs which their clients may need in the future. Despite restrictive ordinances more signs will be used in the future, but they will have to be adapted to the buildings and streets so that they will be less ugly and become an integral part of the structures. Architects can give guidance to proper sign development. Despite the crudity of present electrical advertising, it has become indispensable and even appeals to the esthetic French.

To permit signs to be made an integral part of buildings, recesses, measuring about 8 in. x 3 ft. x 15 ft., should be made above each store front and fed by 1½-in. conduit wired for 175 watts per square foot. These facilities will provide for flush sign lighting equipment of most any type.

Two rows of anchored supports about 1 ft. apart on the corners of buildings are valuable for supporting permanent signs. These avoid unsightly guys and also an expense of $30 to $300 for drilling and inserting supports after a building is constructed. A 1½-in. conduit, suitable for three wires, should be provided for each sign.

Studs for anchoring roof signs cost as much as $50 apiece if put in as an afterthought, whereas they would cost only about $10 apiece if installed initially. They should be provided on three bays back from the wall on the side having the best exposure. A 2-in. conduit will provide for all except the largest roof sign.

Grill or louver construction for signs will avoid the customary gaunt appearance and cut down wind resistance.

All outdoor balconies and architectural tracery afford opportunities for providing contrasting lighting in steady or mobile color.

To allow for festival lighting, which is becoming more and more popular, provision should be made on buildings, when they are built, for supporting festival lighting and providing service connections. Window cleaners' eyebolts are not conveniently placed or strong enough for supporting most outdoor decorative lighting. Stainless steel ornamental supports anchored into the building construction should be provided when the building is erected, near the corners and about 20 to 30 ft. apart on the first and second floors, and every two or more floors above. Service outlets should be provided about 25 ft. apart near the window sills and back of parapet walls, using marine type fixtures, central control, and wiring capable of providing 2 to 10 watts per square foot.

WARD HARRISON
National Lamp Works

The multiplicity of reflectors available makes the problem of light application difficult. The situation would be worse if there were more varieties of light sources. Neon tubes have a big field of application where they are directly visible as a source of light, but are no better than incandescent filament lamps where the light source is shielded. Furthermore, tube lamps are more costly, limited in the position in which they can be used, and less efficient. The same or better results can be accomplished with ordinary incandescent filament lamps if placed back of translucent surfaces.

Frosting of incandescent bulbs was not intended to permit their use unshielded, but rather to help the diffusion of light. Frosting reduces lamp efficiency about 1 per cent throughout their life.

While efficiency may seem insignificant, its increase has been the only means of accomplishing the things now done. To maintain the efficiency of large lamps they should be hung pendant, other-

wise their candlepower efficiency will be reduced 50 per cent before the end of their life. Mill type lamps are rugged, but do not maintain their candlepower throughout life. Round flood lamps are made small to save space and are not advisable for other uses. Large capacity lamps are provided with an internal cleaner tungsten powder.

Ventilation of large lamps can best be accomplished by using an inclosure of ample size to radiate all the heat generated within, and then sealing as tight as possible to exclude the dust.

When color effects are desired it is better to use clear lamps with colored caps than colored bulbs, although the natural colored glass is much better than tinted glass.

When the sun lamp can be used as a general illuminant it will have great applications for producing health rays as well as light. But the widespread use of sun lamps as permanent fixtures in buildings will require much more adequate wiring than we now have. It is possible that cloudy quartz may be used for diffusing the rays of sun lamps for general illumination, but no general plan has been developed for their general application. Louvers of chromium or aluminum might also be used to prevent the ultra-violet rays striking the eye.

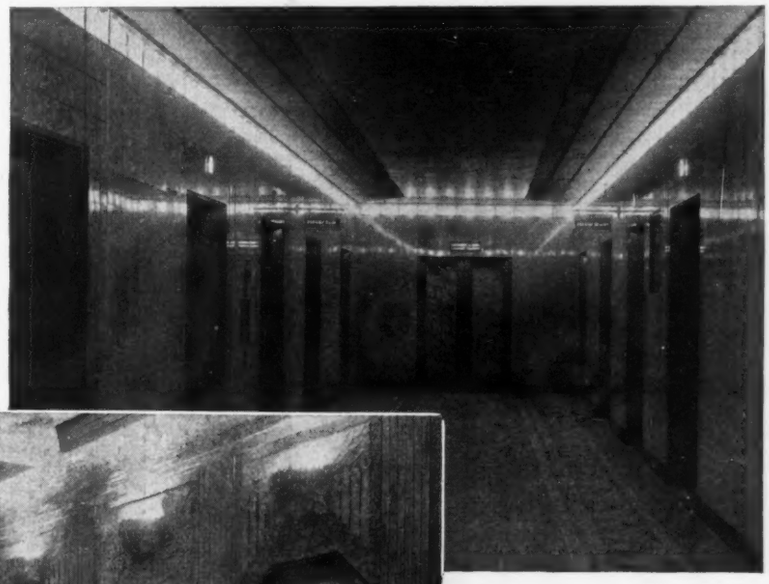
Daylight lamps are not suitable for color matching. However, increasing intensity alone will enable better color discrimination.

Lamp life can be materially increased by reducing the efficiency. But lamp life and efficiency must be balanced against cost of inclosure, cost of lamps and renewals and energy. The minimum total cost is obtained when there is a ratio of 6 to 1 between the cost of energy and the cost of lamp renewals, as a general rule.

Lighting fixtures should be provided which are adapted to the lamps which a customer is most likely to install on replacements, because if a fixture is designed for special lamps, the operating manager will usually substitute cheaper lamps when it comes to replacement.

GEORGE MERRILL
National Lamp Works

With energy at 3 cents per kilowatt-hour and lamps at 50 cents apiece, and renewal labor at



Light panel around elevator corridor in Chanin Building

Courtesy A. L. Powell

How Pan-Hellenic lounge room is illuminated

15 cents apiece, the minimum over-all unit lighting cost is obtained at 5 per cent overvoltage. By operating at under-voltage the lamp renewal cost is reduced, but the lighting cost is increased.

A. L. POWELL
National Lamp Works

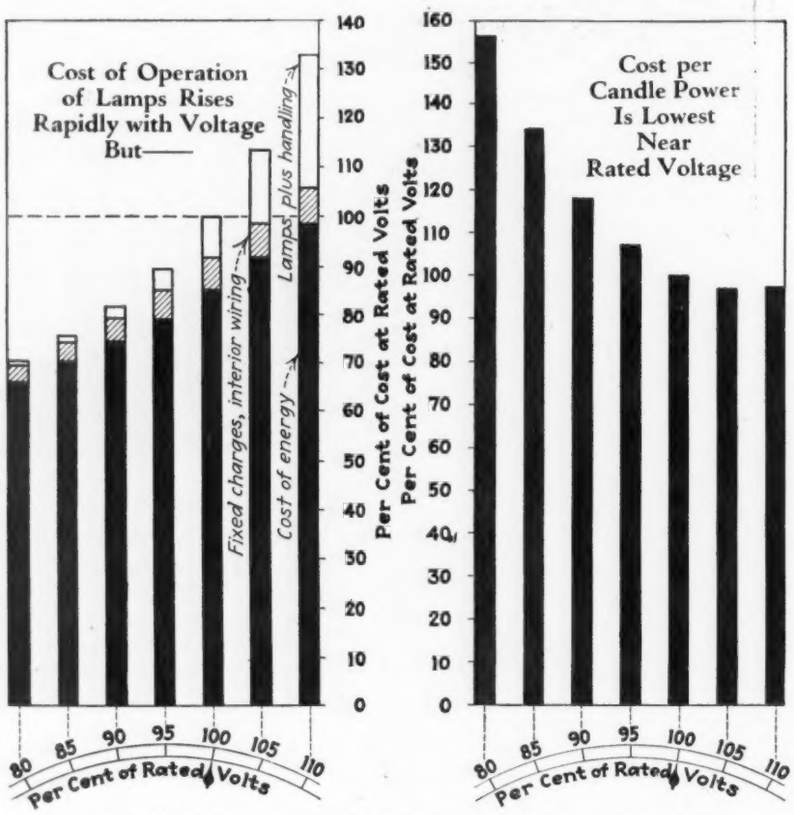
With all the new developments in lighting, architects have the opportunity to create new ideas and put personality into their jobs instead of copying age-old motifs. But lighting should be built into the architecture instead of making it appear as a crude afterthought.

If electrical and illuminating engineers do not take advantage of the new movement of architects in using light to produce artistic effects, and help forward this movement, they will lose their greatest opportunity.

Plans to handle lighting and service facilities should be started as soon as the general design. Architects can visualize the lighting needs and engineers can show them how to make them practical. Many results have been spoiled either by the illuminating engineer not considering the architect's viewpoint or vice versa. Engineers should get over the practice of emphasizing technical details and should envision the bigger ideas. Illumination is an art as well as a science.

Among the newer applications of light are side-wall and ceiling panels of light, utilizing beams of light for ornaments, use of ornamental lighting fixtures and separate sources of general illumination, artificial window lighting, luminous-back display racks and stairways, illuminated translucent-edge mirrors, changing color patterns on ceilings and illuminated glass floors.

While the gaseous tube light source has a great future, the biggest difficulty is in securing desirable colors, as pure colors distort objects.



Based on 200-watt lamps costing 75 cents installed in socket (this would represent purchase under a $600 contract with a handling charge of 14.2 cents per lamp); energy costing 4 cents per kilowatt-hour (this should include demand charges); 1,500 hours' use per year; fixed charges on interior wiring (interest, taxes and depreciation) 12 per cent per year, and mechanical breakage (one lamp each 10,000 burning hours).

L. A. S. WOOD
Westinghouse Electric & Manufacturing Company

In one city there are 45 varieties of street-lighting standards. Other cities have as wide, but perhaps not so extreme, a variety. Such heterogeneous combinations can be avoided if architects will co-operate with cities in selecting the designs of standards and luminaires which should be used in different sections of the city. With a comprehensive plan evolved, the work may be carried on piecemeal, as finances warrant, as Milwaukee, Indianapolis and St. Louis have done.

At present only $1 to $1.25 per capita is spent for street lighting. With an additional $1.50 per capita, social and traffic requirements can be met as safely at night as in the daytime. To avoid the hazards of headlamp glare on highways, it is necessary to have extensive and uniformly lighted highways, but this is impossible, except by state legislation for financing and maintaining highway lighting.

A. F. DICKERSON
General Electric Company

Through the collaboration of architects, artists, illuminating engineers and electrical engineers, it should be possible to create innovations with the new light sources available. Instead of relying entirely on outlined lighting, as was done in the early days of pageants, lighting sources can now be concealed to bring out architectural features; $200,000 was spent in Los Angeles alone for Christmas lighting last year. In the next few years it is expected that all cities will plan on Christmas lighting. The cost of automatic electric fountains has been greatly reduced; they are now less than $20,000.

Electricity Solves Rural Problem

Electric power is effecting a balance between agriculture and industry. It is steadily raising per capita output on the farm. Power growth is not dependent only on population growth. Saturation is farther away than in metropolitan areas.

By FLOYD W. WOODCOCK
President Empire Public Service Corporation

THE public utilities and the electric light and power industry in particular have been responsible for a vast transformation in the small community by making available the comforts, convenience and opportunity known to city dwellers. The introduction of electric light and power into the smaller town increases the productivity of the community even where there is no increase in population. The growth in population, therefore, is no longer the sole basis for measuring the wealth of a community. The many labor-saving machines made possible by electric power greatly increase the per capita output with a corresponding increase in the wealth produced.

The small town is an attractive location for industrial plants. The principal factors that must be given consideration in the location of an industry are: (1) The climate, as it may affect both the product and the worker; (2) the labor supply, whether skilled or unskilled, etc.; (3) nearness to source of raw materials; (4) adequate supply of electric power; (5) transportation of raw material and finished product, and (6) proximity to markets for the product. In many of these requisites the small town offers valuable advantages over the congested industrial areas. Land values are lower, native white labor is more plentiful, wage scales are lower due to lower living costs, transportation is quicker by avoiding congestion of large cities, and the nearness to raw materials and markets frequently reduces transportation expenses and loss of time. A reliable and adequate supply of electric power is, however, the first essential to an industry of any kind. It therefore follows that without adequate power facilities a community cannot develop as rapidly as one with abundant power supply.

Not a new development

The converse of this is also true. The development of these small communities means increasing demands for electric energy. It is readily understood, therefore, that the utility and the community must develop hand in hand and that neither can prosper without the other; the interests of both are identical.

This development of the smaller communities is not new, but has been going on for more than a decade, and the progress made by many of the large operating and holding companies may be traced to interconnection and service to these small towns. For the most part the large cities are highly developed and the saturation is very high. Further development depends on the introduction of new uses for electric light and power, whereas the small community presents virgin territory for development. Frequently the street lighting in those communities is poor or inadequate, display lighting is unknown, electrical merchandising is neglected, rates are inadequately suited to requirements, prohibiting the installation of ranges, refrigeration units, water heaters, etc.; homes are poorly lighted, and in general these communities present wonderfully fertile fields for development through modern commercial and merchandising methods.

The benefits of this growth are not only enjoyed by the utility companies but by the entire territory affected. Such growth means increased wealth to the territory, makes it a better place to live, and creates opportunities heretofore unknown in towns and rural districts.

Large sums are needed to provide the facilities for furnishing this electric light and power service to these communities. The cost of electric current itself is a small part of the total cost of the service. The cost of lines to serve the community is a big factor. The density is relatively low compared with the city and investment per customer is higher. Because the electric business is generally recognized as a regulated monopoly the rate of return on the investment is low, meaning that only a small part of the cost of constructing the facilities

can be provided for out of earnings, and the greater part of the investment must be provided by borrowing money from the public through the issuance of securities.

The business is growing at a substantial rate; it is an essential industry, and it earns a fair return. The securities of public utilities are generally sound because while the return is not high, it is stable. Increased usage by present customers and the requirements of our increasing population assure the future growth, because generally a growing industry is a safe one. The investment in public utilities assists in the development of the communities which they serve, which development, in turn, creates additional demands for electric light and power.

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Electric Melting Improves Quality and Cuts Cost

THE melting of nickel alloys electrically has made rapid progress of late and data recently presented by R. M. Keeney, industrial heating engineer Connecticut Light & Power Company before the American Institute of Mining and Metallurgical Engineers, indicate that the vertical ring induction furnace has become a real competitor of the anthracite pit fire in the production of nickel-silver. More than 90 per cent of the output of the brass rolling mills of the United States is now melted electrically, but until within a comparatively few months a considerable proportion of the nickel-silver output has been pit-fired.

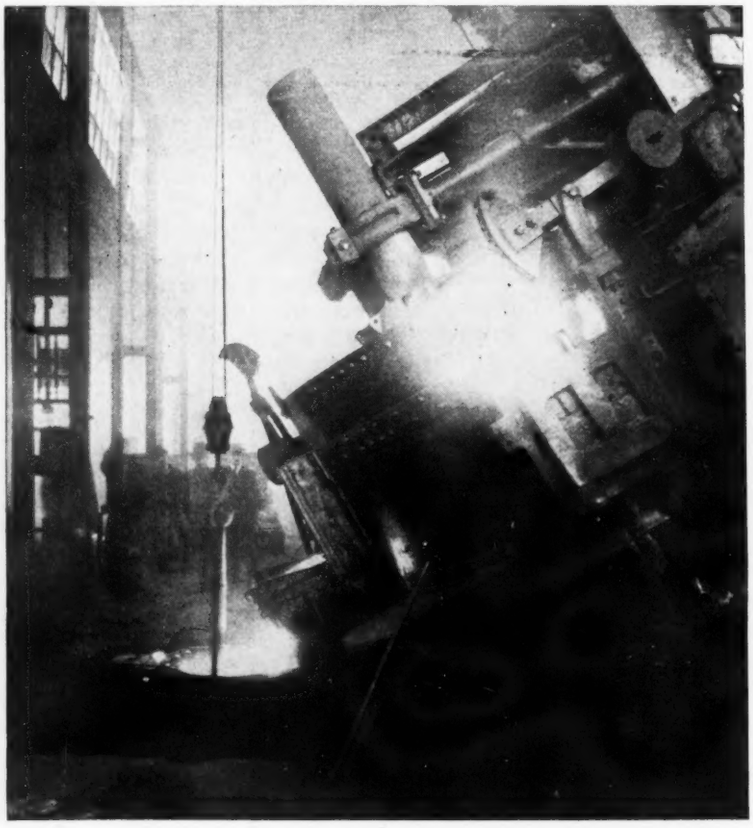
For the following reasons the application of the electric furnace to the melting of nickel-silver has been slow: (1) Until recently no satisfactory lining for the vertical ring induction furnace has been available; (2) the rocking arc furnace, while used in the foundry, has not been favored, possibly because of the adverse effect of the gases present upon the quality of the alloy, and (3) on account of patent rights, the use of high-frequency coreless induction furnace has been controlled by one concern.

About a year ago the first vertical ring induction furnace for melting nickel-silver in the Naugatuck Valley went into service. Results obtained have been so satisfactory as to improved quality of alloy and melting costs that four furnaces are now in operation and five more have been purchased. In each plant the electric furnace replaces the anthracite pit fire. This work has involved development of a suitable refractory lining and a change in channel dimensions. All of the above furnaces are rated at 75 kw. and pour 400 to 800 lb. per heat, with a production of 500 to 550 lb. per hour. The power factor is more than 70 per cent. On 24-hour operation for six days per week the power consumption is 275 to 325 kw.-hr. per ton, including holding power used over Sunday. With further experience it is probable that the power consumption will average 275 kw.-hr. per ton on the 18 per cent nickel alloy.

In one year's experience lining life has increased from 400 heats to more than 800 heats, or about 500,000 lb. per lining. On this basis the cost for lining is $1.40 per ton, and is not likely to exceed $2 per ton of metal poured.

In comparison with the high-frequency coreless induction furnace, the vertical ring induction furnace not only melts nickel-silver with a power consumption approximately 100 kw.-hr. per ton lower, which amounts to a saving of $1 to $1.25 per ton, but also has a considerably lower investment cost when installed in small batteries. This differential grows less as the number of furnaces that can be supplied from a single motor-generator set increases. In the small specialty rolling mill this greater simplicity of equipment is of some importance. Both furnaces produce a higher grade metal than the combustion furnace, because the metal is well agitated and is not exposed to the products of combustion. Electrically melted nickel-silver is said to roll better than the product of the pit fire. In each furnace the metal loss does not exceed 1 per cent, as compared with 2 to 3 per cent in the pit furnace.

Most nickel-silver mills melt some special alloys in such small quantity as to prohibit the use of the vertical



Pouring chromium alloy from an 800-kva. electric furnace

ring induction furnace. The coreless induction furnace is, of course, well adapted to this class of work. The pit fire can be kept in operation at reduced capacity, which is very expensive. In one case a pit fire operating eight hours per day consumed 1,100 lb. of anthracite coal per ton of nickel-silver melted, but in another mill on a twenty-hour day 700 lb. was used per ton melted. One mill has installed inexpensive gas-fired crucible furnaces for this purpose and finds the cost of melting with gas at 65 cents per thousand cubic feet to be about the same as with a battery of pit fires operating at capacity. Silicon carbide has proved to be the most satisfactory lining for the gas crucible furnace.

Table I shows typical comparative costs of melting 18 per cent nickel-silver in the pit fire and in the vertical ring induction furnace. The costs are applicable to an installation melting 10 tons or more per day with 24-hour operation six days per week. Without maintenance and fixed charges included for the pit fire, electric melting is $6 per ton cheaper.

Table I—Cost of Melting 18 per Cent Nickel-Silver

	Anthracite Pit Fire, per Ton	Vertical Ring Induction Furnace, per Ton
700 lb. coal at $13 per ton	$4.55	.....
290 kw.-hr. at 1.15 cents	.....	$3.35
Labor (includes all casting-shop labor)	6.40	3.40
Crucibles	2.00	.....
Refractories	*	1.40
Metal Loss		
Pit fire, 3 per cent, or 60 lb. at 7 cents	4.20	.....
Electric, 1 per cent, or 20 lb. at 7 cents	.....	1.40
Fixed charges, at 16 per cent	*	1.55
Total cost per ton	$17.15	$11.10

*Not available.

J. L. Faden, Boston Edison Company, presented data upon the success of the use of electric heat in melting of nickel chromium alloys, which are used in the manufacture of heat-resisting castings, containers, etc. The essential constituents are nickel, chromium, silicon, aluminum, carbon and manganese.

Electric heat is used in the melting of these alloys in order to maintain the quality and uniformity which are required and to control the chemical composition with precision.

One large plant using electric heat exclusively for the melting of this alloy has an 800-kva., three-phase, 2-ton furnace of the Heroult type for its main production and two 150-kva. melting furnaces for special work.

A record of one daily run is as follows:

Average weight per charge, lb.	1,900
Number of heats	5
Total elapsed time, hours	7
Average kilowatt-hours per ton	668
Approximate pouring temperature, deg. F.	2,850

Electric furnaces are used to some extent in the melting of nickel-copper alloys. One concern manufacturing steam specialties such as valves, gages, etc., uses six 250-lb. capacity arc furnaces. These furnaces have given good service for seven years.

Over a period covering four months' use and melting an alloy consisting of 90 per cent monel metal and 10 per cent tin, the average electrical consumption was 770 kw.-hr. per ton. The average weight of heat was 240 lb. The furnaces are run approximately nine hours per day and are also used for melting copper-tin alloys containing 88 per cent copper, 10 per cent tin and 2 per cent zinc.

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READERS' FORUM

Multiple vs. Series Street Lighting

To the Editor of the ELECTRICAL WORLD:

The article on street lighting by M. S. Gilbert in the April 5 issue of ELECTRICAL WORLD was of particular interest to me, as one who has for years advocated multiple street lighting, in that it indicates that those who have so persistently advocated series systems are starting to realize that perhaps street lighting and high-voltage series circuits are not irrevocably interlinked by the bonds of precedent.

In the tabulated cost comparison given with this article there are, however, a number of factors that have been overlooked, and which, owing to their omission, result in a final summation detrimental to the multiple system.

The cost of $12.20 per lamp for multiple control as given under I-B is far too high. My experience with a system serving a city of close to half a million and using all multiple lighting indicates that around $6 per lamp is ample.

The pro rata allocation of secondary distribution under item II-B is excessive. My experience in the city above mentioned was that the entire street-lighting load could be absorbed by the existing secondary network without any increased investment. The street-lighting peak overlaps the other peaks for only a few minutes during the fall peak. Even if the existing secondary network must be reinforced the cost chargeable to street lighting is only the net cost of this increased capacity, and not the average cost of the entire network after the increased capacity was added. Based on a large number of estimates, I have found that such additional secondary capacity can be added for not more than $20 per kilowatt, which would be $15 per lamp of the size used in the tabulation. Taking a most liberal example where additional capacity would be required in half the cases the secondary system allocation should then not exceed $7.50 per lamp. In the tabulation, which presumably refers to an underground ornamental installation, I see no allowance for the multiple street-lighting cables. Referring to the sketch given for a typical series system, it will be noted that half the circuit area is duplicated for dual schedule control. With a multiple system such control can be operated over a single pilot wire and requires no duplication. The multiple circuit footage would therefore be one-third less than the equivalent series system. In addition, the multiple system would use the lower cost 600-volt cable insulation, as against 3,500 or 5,000-volt for the series. Taking these factors

into consideration, the cost of the multiple feeding cables to the lamp standards would run about $15, making a total cost of $22.50 in place of the $33.70 item used in the tabulation. This makes a total of $17.40 that should be deducted from the multiple system installation cost.

In the series system tabulation the use of isolating transformers for each lamp is indicated, but their cost is omitted from the estimate. Adding these increases the series installation cost by about $24 per lamp.

With these corrections the respective total cost would be $193.05 for the multiple and $242.60 for the series, a difference of approximately 20 per cent in favor of the multiple. This checks very closely with a large number of comparative estimates I have prepared from time to time—estimates that have uniformly shown up favorably for multiple operation at from a minimum of 15 per cent for ornamental systems to as high as 40 per cent for general lighting served by overhead wiring and fixtures.

In the item covering energy consumption lamp wattage ratings have been used. This is a most incorrect assumption. The multiple system is substantially 100 per cent efficient on a lamp wattage basis, since the falling off in wattage with age of lamp almost exactly offsets the circuit losses and those involved in the pilot control system. In the series system the lamp wattage increases with age and becomes cumulatively greater through the loss in high amperage post circuit, isolating transformer, main series circuit and major constant-current transformer. Innumerable authentic tests have shown that these cumulative losses amount to approximately 25 per cent of the lamp wattage rating. Taking this factor into consideration the energy cost given under item V-C for the series should be increased by 25 per cent, making it $36.79 in place of $29.43.

Omitting minor corrections that these changes reflect in the respective operating costs we find that this extra cost for energy for series operation of $7.36 plus 12 per cent on the $24 isolating transformer requires the addition of $10.24 per annum to the series operating cost. In turn, the 12 per cent deduction on the $17.40 excess installation cost of the multiple reduces that operating cost by $2.09. With these corrections the respective operating costs would be $88.38 for multiple and $102.12 for the series, a difference of about 13 per cent in favor of multiple. This makes the multiple system not only cheaper in both installation and operating cost but also cheaper on an annual cost per lumen basis.

Little need be said as to the respective characteristics of the multiple and series type of lamp. The multiple lamp supplied from the existing low-voltage network will give identically the same operating characteristics as supplied all other consumers from the same mains and representing at least 95 per cent of the total lighting load on the system. As the problem has always appeared to me, a service good enough for this 95 per cent should be good enough for the 5 per cent represented by street lighting. Certainly the theoretical extra 10 per cent in average illumination obtained by a series lamp on a series circuit does not justify expending 25 per cent greater energy, an added investment burden on the public of 20 per cent, increased operating costs of 13 per cent and all the hazards and operating complications incidental to wire plant duplication that a series system involves under present practice.

San Leandro, Calif. **S. B. HOOD.**

BOOK REVIEWS

Electrical Distribution Engineering

By Howard P. Seelye. New York: McGraw-Hill Book Company, Inc. 710 pages, illustrated. Price, $6.

Distribution is a major engineering field of activity and covers a multitude of problems in economics and engineering. It is a subject that receives little attention and has not been treated adequately from the design and installation point of view.

In this book a practical engineer with years of experience in distribution has covered the engineering and economic aspects of the subject admirably. The balance of theory, practice and economy is maintained and the information and data are directly applicable to distribution systems.

The author first discusses the subject of distribution broadly and then takes up the subject from the point of view of electrical design, mechanical design and economical design. In the electrical design the fundamental starting point is the load and its characteristic. The different types of systems, including networks, are discussed, principles are stated and applications cited. In the mechanical design both overhead and underground installations are treated fully and in the economical design of distribution principles are stated whereby dollar values can be determined. Many charts, tables and citations from actual installations add to the value of the book.

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Wave Mechanics

By H. T. Flint. New York: E. P. Dutton & Company, Inc. 112 pages, illustrated. Price, $1.25.

This is a small monograph on wave mechanics that should appeal to a wide field of readers. It covers the new method of approach to atomic problems as developed by De Broglie and Schroedinger based on the classical theory of continuity. The discontinuity theory of Bohr, Dirac and Heisenberg is not discussed, but the author does not regard the method used as more powerful or more valid. It is too early to take sides. The monograph is technical in large measure and a valuable aid is a list of supplementary detailed references. It should be very useful to physics students.

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Storage Batteries

By G. W. Vinal. New York. John Wiley and Sons, Inc. Second edition, 427 pages, illustrated. Price, $5.

The physics and chemistry of secondary batteries and their engineering applications are treated by Dr. Vinal in the new edition of his splendid book. It has been rewritten and much new information has been included, especially the use of batteries in aviation and heavy traction. As a complete and balanced treatise of the subject the book is in a class by itself. Especially noteworthy is the engineering application aspect of the work, yet the physics and chemistry are discussed fully and adequately. The new edition should find a ready reception in colleges and with engineers interested in batteries.

Men of the Industry

H. Hobart Porter, president of the American Water Works & Electric Company, has just returned from a cruise around the world aboard the *Columbus*.

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William H. Barthold has been elected president of the Ohio Edison Company, a subsidiary of the Commonwealth & Southern Corporation. Mr. Barthold formerly was a vice-president of the Ohio company, which serves Springfield and numerous other communities.

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W. W. Wolff, formerly district superintendent of the Lake Wales district of the Florida Public Service Company, has removed to Orlando as general superintendent of the company. Mr. Wolff became identified with public utility work in November, 1919, as manager of the Moore Haven ice plant of the Florida Ice & Power Company and subsequently has served at Avon Park, De Land and more recently at Lake Wales.

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William M. Martin has been appointed general superintendent of the Capitol division of the New York Power & Light Corporation with supervision of both gas and electric operations throughout the territory, which includes Albany, Troy, Rensselaer, Watervliet and Cohoes. His headquarters will continue to be at Albany. Previous to his present assignment Mr. Martin was assistant superintendent of power supply operation for the corporation in direct charge of hydro stations and transmission.

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L. E. Merrow has resigned as chief engineer of the Green Mountain Power Corporation, Burlington, Vt., to join the engineering staff of the New England Public Service Company with headquarters at Augusta, Me. Mr. Merrow joined the Montpelier & Barre (Vt.) Light & Power Company's organization in 1923, soon becoming general superintendent. More recently he has been assistant to the general manager of the Green Mountain Power Corporation, following the consolidation of the Burlington Light & Power Company and the Montpelier & Barre company. Mr. Merrow has been active in the Vermont Electrical Association for some time and is one of the best known electrical operating men in the Green Mountain state.

A. F. Morairty Heads Arizona Association

A. F. Morairty, assistant general manager of the Central Arizona Light & Power Company, Phoenix, was elected president of the Arizona Utilities Association at its recent annual convention. He has been associated with the Central Arizona Light & Power Company for five years, having gone to Phoenix from Denver, Colo., where he was assistant to the general superintendent of the Public Service Company of Colorado. When he arrived in Phoenix in August, 1925, he took up the work of establishing a sales department for the Central Arizona company. Early in 1928 he relinquished his position as commercial manager to become assistant general manager of the company.

A native of Boulder, Colo., Mr. Morairty received his preliminary schooling in Denver and was graduated from the University of Michigan in 1911 with the degree of electrical engineer. He started his career in plant construction work with the Colorado Power Company, predecessor of the Public Service Company; he has been substation operator, steam plant operator, assistant dispatcher, assistant local manager, local manager and district manager at Alamosa for the Public Service Company. Mr. Morairty always has taken a prominent part in electrical association work and in addition has been active in civic affairs.

Farley Osgood, consulting engineer of New York and a past-president of the American Institute of Electrical Engineers, has been elected a vice-president and director of the Security Distributors Corporation, New York.

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E. D. Alexander, formerly vice-president of the Illinois Northern Utilities Company with headquarters in Dixon, has been elected president of that company to succeed Martin J. Insull of Chicago, who became vice-chairman of the board. George Fluehr, superintendent of district A, was elected vice-president to succeed Mr. Alexander.

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Robert M. Eames has been made general manager of the Bryant Electric Company, to succeed Marcus A. Curran, who recently resigned on account of ill health. A graduate of Union University and of the Albany Law School, Mr. Eames joined the sales force of the Bryant Electric Company in 1906. In 1914 he organized and became the head of the export department of the company and in 1921 was named general sales manager.

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Henry L. Doherty, president of the Cities Service Company and of Henry L. Doherty & Company, has been made the recipient of the Walton Clark medal in recognition "of his outstanding and valuable work in the development of the manufactured gas industry." Presentation will be made in the Franklin Institute in Philadelphia May 21, the exercises to be followed by a dinner in his honor at the Bellevue-Stratford Hotel. The Walton Clark medal is awarded annually on the recommendation of a group of experts appointed from the sixty men on the institute's committee of science and arts.

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S. Murray Jones and F. G. Hart, both of whom have spent a number of years in the operating departments of public utility companies, have recently joined the power utilities division of the Ohio Brass Company, Mansfield, Ohio. Mr. Jones joins this organization with seven years' experience in the electrical field. Following his graduation from Massachusetts Institute of Technology in 1922, he has done engineering and system planning work with the Alabama Power Company, Carolina Power & Light Company and the Southeastern

Engineering Company. Mr. Hart has been connected with the engineering department of the Topeka-Edison Company, which later became the Kansas Power & Light Company, where he has had extensive experience in electrical design and construction of power plants and transmission lines.

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LEWIS C. CONANT, formerly chief illuminating engineer of the Buffalo General Electric Company, has been appointed to direct the lighting service bureau, which has recently been established by the Buffalo, Niagara & Eastern Power Corporation.

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MARSHALL FIELD, of Field, Glore & Company, has been elected a director of the United Light & Power Company. Mr. Field is a director of other large organizations, including the American Light & Traction Company, the Chicago & North Western Railway Company, the Continental Illinois Bank & Trust Company and other industrial enterprises.

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ROBERT W. ROLLINS has severed his connection with the New England Power Association, following the termination of a contract entered into at the time of the purchase of the Worcester Electric Light Company by the former organization last year. Mr. Rollins was president and general manager of the Worcester company for about ten years preceding its acquisition, formerly having been general manager of the Hartford Electric Light Company. He is a past-president of the New England Division of the National Electric Light Association.

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M. E. COOLEY, dean emeritus of the colleges of engineering and architecture, University of Michigan; E. L. RYERSON, Joseph T. Ryerson & Son, Chicago, and JOSEPH W. ROE, professor of industrial engineering, New York University, have been appointed engineering advisers to aid in the work of organizing the Industrial Museum founded in Chicago by Julius Rosenwald. Dean Cooley is a past-president and an honorary member of the American Society of Mechanical Engineers, past-president of the Society for the Promotion of Engineering Education and past-director of the American Society of Civil Engineers. Professor Roe is a past-president of the Society of Industrial Engineers and a member of the American Society of Mechanical Engineers, the Taylor Society and the Society for the Promotion of Engineering Education. Mr. Ryerson comes from a Chicago family which for several generations has been prominent in the wholesale iron and steel business and in civic affairs. He is a member of the Society of Industrial Engineers.

Samuel D. Fitzsimmons
Power Sales Manager

SAMUEL D. FITZSIMMONS has been appointed power sales manager of the Narragansett Electric Company, Providence, R. I., reporting to R. F. Whitney, vice-president. He will be responsible for power sales activities in the Narragansett, South County Public Service Company and the Mystic Power Company. He will co-operate with Hugo Rocktashel, sales manager of the New England Power Association, in connection with power negotiations in excess of 300 kw.

Mr. Fitzsimmons began his engineering career in the power department of the Jencks Spinning Company, Pawtucket, R. I., and six years later joined the staff of J. & P. Coats Company, Pawtucket, as operating engineer. For a short time he was in the electrical contracting field and later was employed by the State of Rhode Island in the capacity of mechanical engineer. Following this connection, he entered the field of consulting and sales engineering and in 1920 joined the Brown & Sharpe Manufacturing Company as plant engineer in charge of power construction, maintenance and plant layout. He has served as chairman of the plant engineering section of the Manufacturers' Research Association and is a past-president of the Providence Engineering Society.

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PAGE GOLSAN, recently vice-president of the Great Western Portland Cement Company of Kansas City, has just been appointed manager of the new-business department of the engineering organization of Ford, Bacon & Davis of New York. Mr. Golsan was associated with this engineering organization for many years before taking up his duties with the Great Western Portland Cement Company of Kansas City, and now returns to take charge of new-business activities.

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GEORGE ROBERTS has been elected a director of the Niagara Hudson Power Corporation. Mr. Roberts is also serving on the directorate of the American Superpower Corporation.

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ALBERT H. WOOD, formerly connected with the Public Service Corporation of New Jersey, has resigned to become manager of the commercial department of the Kansas City Public Service Company, Kansas City, Mo.

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MASON T. WHITING has joined the Stone & Webster Engineering Corporation as hydraulic engineer in the Boston office. He was formerly on the staff of Charles T. Main, Inc., Boston, and has been connected with many hydro-electric projects in the United States and Africa. Recently he has been occupied on work for the Central Hudson Gas & Electric Corporation and the Rockland (N. Y.) Light & Power Company.

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THOMAS S. BURNS, who for the past seven years was hydro-electric engineer with the Power Corporation of New York and the Northern New York Utilities, Inc., until the absorption of these two companies into the Niagara Hudson Power Corporation, has been appointed senior hydro-electric engineer in the United States Engineer Office, War Department, under Lieut.-Col. J. J. Bain, district engineer of the Pittsburgh district. Mr. Burns will be engaged in studies of water-power resources, markets for hydro-electric energy, combinations of navigation improvement and flood relief.

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OBITUARY

THOMAS CRAWFORD, who had been active for many years in Iowa utility circles, died April 29 following an illness of two months. Mr. Crawford was born in Sterling, Ill., and was graduated from the University of Illinois. Immediately after graduation he became superintendent of the Sterling Gas & Electric Company, but in 1905 he removed to Clinton, Iowa, as manager of the Clinton Gas & Electric Company. About a year ago he resigned as general manager of the Interstate Power Company. Mr. Crawford was a past-president of the Iowa Electrical Association.

Financial and Statistical News

HEAVY accumulation of utility bonds and common stocks this week was attributed to investment trusts and other institutional buyers who took advantage of the low levels reached in the drastic selling movement. Volume of trading in utility stocks was the heaviest since the October break.

——MUCH IS HEARD OF THE FACT that the market advance has proceeded much more rapidly than the corresponding business recovery. Many brokers look for a period of lethargy following this week's adjustment, pending a more substantial business recovery. The earnings position of stocks is being more carefully scrutinized by investors.

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California Utilities Active in New Financing

BEFORE LESS THAN four months of the present calendar year had expired the Railroad Commission of California had already authorized the issuance of more public utility securities during 1930 than during the entire calendar year of 1929. The commission has authorized the issuance of $163,559,965 of stocks, bonds and other evidences of indebtedness by California public utilities for 1930. The total amount of such securities authorized during 1929 was in excess of $103,288,000. There are now pending before the commission nearly $50,000,000 in applications for authority to issue such securities. The figures for 1929 were the lowest in many years, but those for 1930 indicate a strong recovery.

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Niagara Hudson Buys Union Bag Subsidiary

ANNOUNCEMENT IS MADE that Niagara Hudson Power Corporation has purchased from the Union Bag & Paper Company all of the common stock of the Union Bag & Paper Power Corporation, which owns three hydro-electric power plants on the Upper Hudson at Hudson Falls, N. Y., with a total installed capacity of 10,000 hp. The consideration was not revealed, but it was sufficient to retire all outstanding bonds of the Union Bag & Paper Power Corporation, amounting to $3,000,000, and to pay off all the Union Bag & Paper Company's bank loans and other indebtedness, it is understood. The sale involves transfer of the purchased company's water-power rights at Hudson Falls, N. Y.

The Hudson Falls power plants acquired by Niagara Hudson Power are already tied in with its system, and will be operated in connection with the plants of the New York Power & Light Corporation, a subsidiary. The sites purchased are only partially developed, and constitute the second largest undeveloped water power on the Upper Hudson. The value of the sites will be enhanced by operation of the new Sacandaga Reservoir, now being filled, as will other power sites downstream from the Sacandaga, a Hudson tributary.

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Sweden's Output Increased 11 per Cent

STATISTICS PUBLISHED by the Svenska Elektricitetsverksfoeringe show that the production of electric power in Sweden during last year amounted to 4,850,000,000 kw.-hr., an increase of 475,000,000 kw.-hr., or nearly 11 per cent over 1928. The increase was greatest in north Sweden, where certain industries are large consumers. In central Sweden, where no new sources of power of importance were inaugurated during the year, the increase in consumption was about 14 per cent, while in southern Sweden there was a decrease of about 6 per cent, owing to shortage of water.

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March Output Rises in Farming Country, Falls in Autoland

Energy Generated
Revenue
Per Cent
20
15
10
5
0
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1928
1929
1930

ELECTRIC public utility energy output in March was only 2 per cent greater than that for the corresponding month in 1929, according to statistics compiled by the U. S. Geological Survey. Although the survey includes electric railways, the rate stated will probably apply also to the electric light and power industry alone.

The decrease of 3 per cent in the average daily production from 272,000,000 kw.-hr. in February to 263,000,000 kw.-hr. in March is normal, but the gain compared with 1929 is smaller than usual. The rate attained its peak last April, when the increase over the corresponding month of the preceding year rose to 17 per cent. It has been falling more or less steadily since—10 per cent in November, 6 in December, 5 in January and 3 in February.

Meanwhile the great agricultural area comprising the West North Central division reports the remarkably large increase of 11 per cent, and some individual states in it go much higher—

North Dakota 31 and Iowa 21 per cent. In addition, some industrial regions continue to make a fairly favorable showing. The Middle Atlantic States gained 6 per cent; New England made neither gain nor loss. The weak section continues to be the East North Central, with 2 per cent average decrease, and 8 per cent in Michigan.

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Power Gains in California

INTERCONNECTED COMPANIES in California generated 5.63 per cent more power in February, 1930, than in the corresponding month of 1929; the increase for the northern companies was 5 per cent and for the southern 6.37 per cent. The aggregate output for the two groups of companies was 632,108,172 kw.-hr.

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NEW CAPITAL ISSUES

FIRST AND REFUNDING mortgage gold bonds, series C, of the Puget Sound Power & Light Company to the amount of $9,000,000 have been offered at 95½ and accrued interest, to yield 5.37 per cent. These 5 per cent bonds, dated May 1, 1930, will mature May 1, 1950. Proceeds from the sale will be applied toward the discharge of obligations incurred for additions to plant and for payment of maturing bond and note issues; for further additions to plant and for other corporate purposes. More than 98 per cent of the common stock and all the junior preferred stock of Puget Sound Power & Light are owned by Engineers Public Service Company.

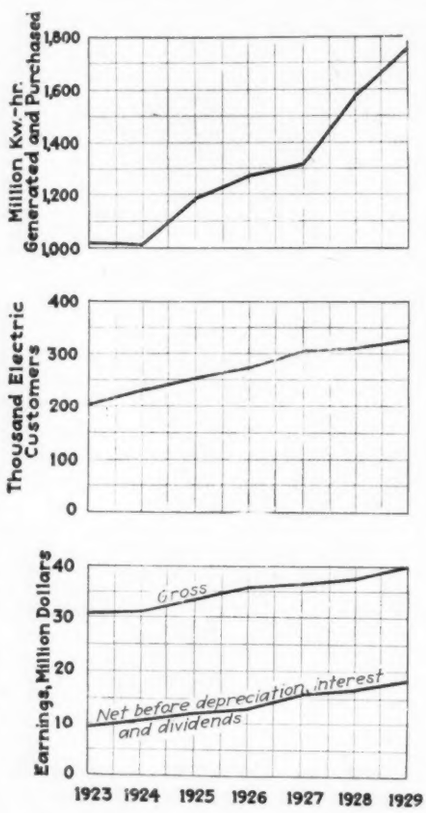
Piedmont Hydro-Electric Company (Società Idroelettrica Piemonte) issued first mortgage and refunding 6½ per cent sinking fund gold bonds, series A, a piece of financing involving a total of $10,000,000. Organized in 1899, S. I. P., is both a holding and an operating company and, together with its subsidiary and affiliated companies, constitutes one of the most important public utility groups in Italy. Twenty-five million Swiss Francs, series B, bonds of this issue are being offered simultaneously in Switzerland and Holland.

Iowa Southern Utilities Company made an offering of 6 per cent gold debentures, series A, to the amount of $2,500,000, the price being 98 and accrued interest to yield over 6.17 per cent.

City of Tacoma, Washington (electric light and power department), issued 4¾ per cent bonds to the amount of $3,350,000 at prices to yield 4.80 per cent.

New England Power Strides Forward

WITH gross assets of nearly $300,000,000, compared with $237,000,000 the year before, the New England Power Association closed its office doors on the last day of 1929 with a record of expansion notable in the annals of the power industry in the northeast. Gross earnings for the year totaled $40,408,008, against $37,264,000 for 1928, allowing for acquired properties, and the total output was 1,751,000,000 kw.-hr., compared with 1,581,000,000 the year before. The system now serves 326,447 electric customers, or a gain of about 10,200 in the year. During the year about $20,000,000 was expended on new construction, and this figure will be exceeded in 1930. The association is settling down into a great property occupying the heart of central New England, interconnected on all sides with other systems and squared away for commercial development on a truly regional scale.



Expansion of business features New England Power System

Water shortage in 1929 caused the association to generate 573,459,000 kw.-hr., against 693,900,000 kw.-hr. in 1928, and this spread would have been still greater had not skillful operation been practiced. All industries served except textiles purchased more power during the year, and nearly 500 new power customers were added, representing an increased load of more than 25,000 kw. and more than 50,000,000 kw.-hr. About $2,000,000 worth of gas and electric appliances were sold. Rate reductions were made in eleven subsidiaries. About 125 construction jobs were carried on, employing 3,700 men at the peak of activity.

The Fifteen-Mile Falls project on the Connecticut River has been pushed steadily forward and it is expected that the initial development of 156,000 kva. will be in operation October 1. Ultimately three hydro plants will be in use in this vicinity, developing 340,000 hp. and producing 500,000,000 kw.-hr. annually.

From this development New England's first 220-kv. line will deliver power in bulk to eastern Massachusetts. Important retail companies at Worcester, Fall River and Attleboro, Mass., were acquired during the year and rapid co-ordination of subsidiaries into the system is under way.

Summary of Earnings (Consolidated) 1929

Gross operating revenue (eliminating inter-company sales)	$38,196,784
Total income	40,408,008
Operating expenses, maintenance and taxes	21,623,870
Consolidated net earnings before depreciation	10,968,231
Consolidated net earnings after depreciation	8,002,453
Preferred dividends (N.E.P.A.)	3,487,578
Net earnings applicable to common stock (N.E.P.A.)	4,514,875

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Canada's Output Increased 3 per Cent

FEBRUARY OUTPUT OF central electric stations in Canada was about 3 per cent greater than in the corresponding month of 1929, reaching a total of 1,391,620,000 kw.-hr. This is a fraction of a per cent better than the showing made in January. The average daily production for the two months was almost identical, 49,922,000 kw.-hr. in the first month and 49,700,000 kw.-hr. in the second month of the year. Of the total production, all but 26,731,000 kw.-hr. came from water power.

Most of the provinces show an increase, Quebec, 6 per cent, Ontario, 4 per cent and British Columbia, 5 per cent. These are all better than the gain for the country as a whole; they are partly counterbalanced by a decrease of 20 per cent in the prairie provinces where, however, only 6 per cent of the total energy output originates.

Recent Listings on Stock Exchanges

The Boston Stock Exchange has authorized the listing of $2,000,000 of additional 6 per cent convertible gold debentures of the American Electric Power Corporation, series A, due September 15, 1957. The New York Stock Exchange has authorized the listing of 175,000 additional shares of class A stock (no par) of the International Hydro-Electric System on official notice of issuance upon conversion of preferred stock, convertible $3.50 series of the company, with authority to add 85,000 additional shares of class A stock, on official notice of issuance upon exercise of class A stock purchase warrants, making the total amount that has been applied for 1,619,854 shares of class A stock.

There has been also authorized for listing on the Big Board 146,189 additional shares of common stock (no par) of the Pacific Lighting Corporation upon official notice of issuance and payment in full in connection with offer to stockholders, making the total amount applied for to date 1,609,198 shares.

The New York Stock Exchange has authorized the listing of 500,000 additional shares of common stock (no par value) of the United Corporation on official notice of issuance in connection with the acquisition of certain additional shares of stock and 30,000 additional shares of 6 per cent cumulative preferred stock of the Virginia Electric & Power Company on official notice of issuance for cash, making the total amount applied for 75,130 shares.

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Greater Production of Electricity in Germany

CONTINUED PROGRESS in the electrification of Germany is indicated by figures recently made public by the German Statistical Office, transmitted to the Department of Commerce by Trade Commissioner James E. Wallis, Jr., at Berlin.

During the year 1929 the production of current by 122 German central stations amounted to 16,900,000,000 kw.-hr., as against 14,400,000,000 kw.-hr. in the previous year. This represents an increase of approximately 17.6 per cent. Since these stations produce about half the total output of electric power, it may be assumed that the country's entire production for 1929 was not far from 34,000,000,000 kw.-hr.

During November, 1929, the current consumed by 103 industrial plants was roughly 13 per cent higher than in November, 1928. A still further increase in the total and average daily production was recorded in December, the gain amounting to approximately 14 per cent as compared with the figure for December, 1928.

South Leads in Hydro Growth

A RECENT REPORT by the U. S. Geological Survey indicates that water-power development has been relatively more rapid in the South and West than in other parts of the country.

The percentages in the table relate to the totals for the United States of 7,926,958 hp. in November, 1921; 10,033,655 hp. in March, 1925, and 13,807,778 hp. on January 1, 1930.

Distribution of Developed Water Power in United States 1921, 1925, 1930

Division	—Percentage of Total in United States— 1921	1925	1930
New England	16.5	14.0	11.9
Middle Atlantic	18.7	19.4	15.3
East North Central	9.3	8.8	7.8
West North Central	5.6	5.1	4.0
South Atlantic	13.6	15.8	19.2
East South Central	3.1	4.0	8.4
West South Central	.2	.3	.4
Mountain	10.4	9.3	8.6
Pacific	22.6	23.3	24.4

The complete report shows the trend of water-power development in different sections of the United States, the change in rank of the important water-power states since 1921 and the total capacity on January 1, 1930, of water-wheels in each state segregated by public utility plants and manufacturing plants.

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

	1930	1929	Per Cent Increase	Operating Ratio 1930	1929
American Light & Traction & Subs. (Year ended March 31)					
Gross earnings	$47,331,052	$43,635,695	8.4	65	65
Net earnings	16,617,999	15,342,238	8.3	..	..
Associated Gas & Electric System (Year ended March 31)					
Gross earnings	100,979,022	50,090,053	102	50	55
Net earnings	50,577,630	22,554,806	124	..	..
Baton Rouge Electric (Year ended March 31)					
Gross earnings	1,294,798	1,154,731	12.2	..	..
Net earnings	453,846	447,793	1.3	..	..
Eastern Utilities Associates (Year ended March 31)					
Gross earnings	9,399,140	8,758,107	7.3	..	..
Net earnings	3,804,134	3,368,015	13.0	..	..
Eastern Texas Electric & Subs. (Year ended March 31)					
Gross earnings	9,972,376	8,400,363	18.7	..	..
Net earnings	4,197,247	3,466,219	21.1	..	..
El Paso Electric & Subs. (Year ended March 31)					
Gross earnings	3,577,220	3,262,482	9.6	..	..
Net earnings	1,546,630	1,329,917	16.3	..	..
Federal Light & Traction & Subs. (Year ended March 31, 1930)					
Gross earnings	8,424,014	8,107,088	3.9	55	56
Net earnings	3,549,695	3,320,013	6.9	..	..
Galveston-Houston Electric & Subs. (Year ended March 31)					
Gross earnings	5,171,041	5,252,217	—1.7	..	..
Net earnings	1,659,514	1,701,087	—2.5	..	..
Illinois Power (Year ended March 31)					
Gross earnings	2,916,601	2,786,520	4.7	64	64
Net earnings	1,043,935	992,085	5.2	..	..
Kansas City Power & Light (Year ended March 31)					
Gross earnings	14,600,032	13,986,796	4.4	50	51
Net earnings	7,308,213	6,848,658	6.7	..	..
Middle West Utilities (Year ended March 31, 1930)					
Gross earnings	$169,447,074	$148,787,501	13.9	..	..
Net earnings	24,675,429	18,836,351	30.9	..	..
Northern Texas Electric & Subs. (Year ended May 31)					
Gross earnings	2,645,929	2,816,255	—6.0	..	..
Net earnings	819,377	861,392	—4.9	..	..
Ohio Edison (Year ended March 31)					
Gross earnings	2,324,578	2,181,609	6.5	48	49
Net earnings	1,208,041	1,121,292	7.7	..	..
Puget Sound Power & Light & Subs. (Year ended March 31)					
Gross earnings	16,729,581	15,421,546	8.4	..	..
Net earnings	7,032,753	6,420,820	9.5	..	..
Savannah Electric & Power (Year ended March 31)					
Gross earnings	2,209,446	2,213,409	—0.1	..	..
Net earnings	1,030,500	991,318	3.9	..	..
Sierra Pacific Electric & Subs. (Year ended March 31)					
Gross earnings	1,422,744	1,418,958	0.1	..	..
Net earnings	599,680	642,393	—6.7	..	..
Southern California Edison (Year ended March 31)					
Gross earnings	40,799,484	36,426,571	12	33	33
Net earnings	27,390,542	23,891,726	15	..	..
Southern Indiana Gas & Electric (Year ended March 31)					
Gross earnings	3,399,105	3,237,586	5.0	56	57
Net earnings	1,500,824	1,373,346	9.2	..	..
Tampa Electric & Subs. (Year ended March 31)					
Gross earnings	4,578,688	4,630,514	—1.1	..	..
Net earnings	1,500,223	1,460,639	2.7	..	..
Texas Power & Light (Year ended March 31)					
Gross earnings	9,843,200	9,633,420	2.2	..	..
Net earnings	4,833,255	4,744,511	2.9	..	..
Virginia Electric & Power & Subs. (Year ended March 31)					
Gross earnings	17,129,442	16,448,021	4.0	..	..
Net earnings	7,787,855	7,216,902	7.9	..	..

Business News and Markets

American Control of Electric Operations Abroad

DISCUSSING the control of electrical operations abroad by American capital recently, John A. Crabtree, managing director of J. A. Crabtree Company, Ltd., made some interesting comments on the possible results of American policy. He said in part:

"The study of the British Electrical and Allied Manufacturers' Association report, however, when supplemented with other information, emphasizes the importance of American capital in the electrical industry throughout the world. It is difficult to find any parallel in any other field of industry, with the possible exception of motors, oil or matches. We find the American General Electric Company, for example, operating extensively not merely in America, but in all the British Dominions, in the leading countries on the Continent, and, not least, within some of the largest electrical concerns in this country. This is largely a result of the war and from the disturbance of the currencies and liquidation of war debts consequent upon the war.

"It has to be faced as a basic fact, and I have no patience with those who spend their time reviling this growth of American interest and control. At the same time, all our policy and outlook in the British electrical industry must be governed by this fact, although it may be too early as yet to foresee how it will operate. I have my doubts as to whether it will ultimately bring the benefits to the American interests which our American friends expect, and here I refer not merely to the electrical industry, but to the whole policy of American control as at present being expressed. The position is, that America as a nation is ceasing to export manufactured goods, and is tending to export her factories. Whatever profits those factories make must in turn remain overseas and be reinvested in more and more factories. Ultimately, America may find that she has made a serious miscalculation, but at present that end is too far distant to be a matter for immediate consideration.

"For the moment, therefore, the world has to recognize this infiltration of American capital and control into the world's industries, and that this infiltration is going to have a very profound effect during the next decade. We have already seen the desperate struggles of certain British companies in their endeavor to maintain their independence, and I am satisfied that no public company whose shares are freely quoted on 'change can ultimately maintain its freedom if America is interested, and desires 'co-operation' in the modern financier's meaning of the word."

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Claude Neon Interests Organize British Company

CLAUDE NEON INTERESTS, in association with General Electric Company, Ltd., of England, and Aktiengesellschaft für Elektrizitäts-Industrie of Germany, commonly known as the Osram Company, have organized the Claude-General Neon Lights, Ltd., with headquarters in London. The new company will operate under the Neon patents of Georges Claude throughout Great Britain and Ireland. They will manufacture gaseous tube lighting for commercial displays, outdoor advertising and other illuminating purposes.

The board of directors includes Messrs. Wilson and Fletcher, representing the General Electric Company of England interests; Julius Siess, representing the German interests, and W. T. P. Hollingsworth, president of Claude Neon Lights, Inc., of New York, with H. Marryat as chairman of the board. Mr. Moyse will be general manager and Mr. Higgins of the engineering staff of the General Electric Company of England will be manager of the plant.

The company has absorbed the Buro Sign Company, Ltd.; Atomlite, Ltd.; Neon Lights, Ltd., and Illuminated Advertising Company, Ltd., of London. The last two companies had previously been manufacturing electric displays under the Claude patent rights.

Reciprocity Should Be Outlawed

"THIS company aims to buy, just as it tries to sell, on merit alone.

"The pressure of reciprocity should be outlawed by the management of all upstanding organizations.

"There is no substitute for quality and service."

—Columbia Steel & Shafting Company.

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European Turbine Agreement Made

AN AGREEMENT has just been concluded between the German A.E.G. and Siemens undertakings and the Swiss Brown-Boveri Company to purchase from the M.A.N. Company licenses for the construction of Ljungstrom turbines. The M.A.N. organization itself bought the rights from the designers a few years ago. The three companies concerned control almost the whole of the continental turbine market, the A.E.G. having the largest sales in Germany and also exporting to other European countries and overseas.

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Tariff on Poles Subject to Adjustment

THE TARIFF DUTY of $1.50 per thousand feet board measure which the Senate placed on poles for electric light, telephone, telegraph and trolley purposes has been rejected by the House. If the Senate recedes from its position in a vote which may come before this appears in print, the pole duty will be finally settled and poles will remain on the free list as in existing law. If, however, the Senate will not concur, the item will go to conference with such others as remain contested. The rate on cement is fixed at 6 cents per 100 lb., but it remains to be decided whether cement for state and municipal purposes shall enter duty free. All other rates of interest to the electrical industry have been put into final form.

Manhattan Electrical Stock Investigated

THE COMPLETE ABSENCE of trading in Manhattan Electrical Supply common stock last week in an active market is the subject of an investigation being conducted by Deputy Attorney-General Watson Washburn. It is understood that there were large offers of the stock for sale, but that buying orders were lacking, hence there were no transactions for several days. This stock has been the subject of spectacular market movements this week.

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Dubilier Announces Expansion Program

IN LINE WITH ITS general program of merchandising expansion, the Dubilier Condenser Corporation of New York City has acquired two new outlets for its products. The Evan Williams Electric Sales Company, Milwaukee, Wis., has been appointed Dubilier representative, covering jobber, manufacturer and industrial sales throughout the state of Wisconsin. A few states further west finds the E. B. Henderson Company, St. Louis, Mo., now representing Dubilier throughout the entire state and in the southern half of Illinois.

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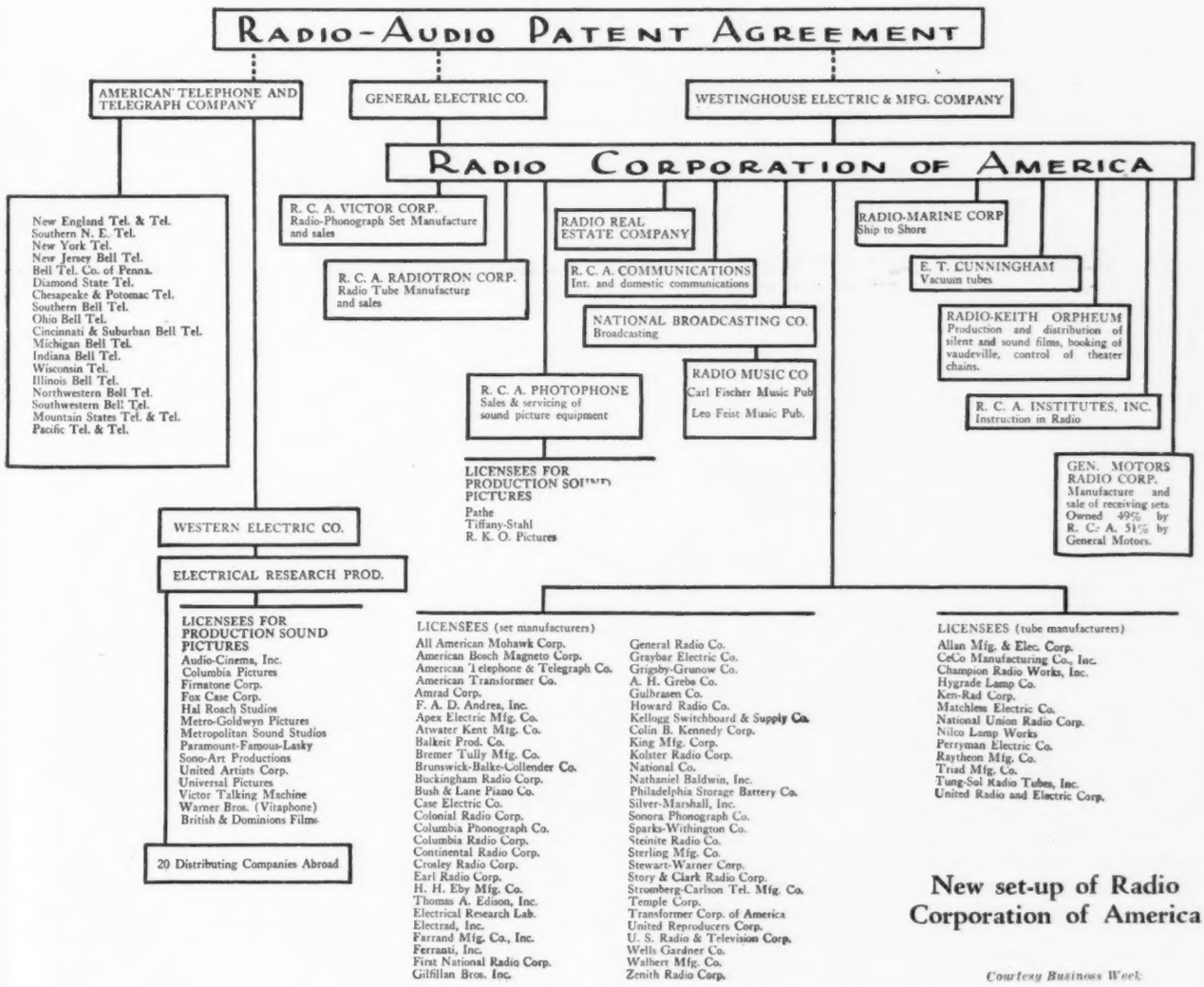
National Electric Buys Inca Corporation

NATIONAL ELECTRIC PRODUCTS CORPORATION of New York and Pittsburgh, manufacturer of copper wire, cables, conduit and wiring devices, has purchased the Inca Manufacturing Corporation of Fort Wayne, Ind. Acquisition of the Inca company gives the National Electric organization a Middle West location. George A. Jacobs, who played an important part in the affairs of the Inca Manufacturing Corporation, will become a vice-president of the National Electric Products Corporation and a few of his associates will take part in the development of Inca as a division of National Electric Products.

Copper at 12 Cents New Low Level

WITH THE SALE of a substantial tonnage of copper at 12 cents a level was reached at which many prominent consumers have declared their intention of coming into the market in a big way. Whether or not they will do so, or whether the sharp decline of the last three days will merely make them revise their ideas of a bargain to 11 cents, remains to be seen, for the 12-cent price has not been in effect long enough to determine its effect, either on production or sales. The 14-cent quotation was generally adhered to by all sellers for just three weeks, lacking one day, before the price was reduced.

	April 30, 1930 Cents per Pound	May 7, 1930 Cents per Pound
Copper, electrolytic	14	12
Lead, Am. S. & R. price	5.50	5.50
Antimony	7¼	7¼
Nickel, ingot	35	35
Zinc, spots	5.05	5.00
Tin, straits	33¾	32¾
Aluminum, 99 per cent.	24.30	24.30



New set-up of Radio Corporation of America

Courtesy Business Week

Market Conditions

CAUTION in making new commitments characterizes equipment buying in virtually all parts of the country. This is attributed partly to uncertainty in copper prices and partly to the general business situation. Day-to-day orders in the New England area and in the Southeast are close to normal, but the tone in general is quiet.

——POWER COMPANY BUSINESS IS ACTIVE on the Pacific, but volume is below normal.

——SALES ARE WELL MAINTAINED in the Southwest district.

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PACIFIC COAST

—DECLINING COPPER AND CONDUIT *prices have accentuated the prevailing spirit of caution. Building of all kinds is very light, although the fact that building costs are estimated at 25 per cent below those of the past several years may produce some action on present projects.*

Power company business includes one carload of pole line hardware for Oakland and one of insulators for San Joaquin Valley, ten assorted carloads of poles for telegraph and power lines and one carload of ¼- and ⅜-in. strand for Los Angeles. Machinery orders cover $35,000 worth of meter panels, benchboard panels, a 24-panel General Electric switchboard for San Francisco installation and three Westinghouse feeder regulators valued at $40,000 for San Francisco; also $15,000 worth of oil drilling motors for southern California fields and $15,000 worth of fan motor bodies for Los Angeles. Westinghouse reports two carloads of ranges sold to a Los Angeles jobber and one carload to Salt Lake City. Seattle business, hitherto good, despite the lumber depression, is somewhat quieter. The Eureka district is hit by decreased lumber wages. The 40,000-kva. turbine for Fresno installation, a $500,000 order, is still in abeyance.

The Westinghouse company has secured the contract for furnishing approximately $125,000 worth of electrical apparatus for Centralia, Washington's municipal power project, apparatus involving six 1,667-kva. transformers, two 73,400-amp. oil circuit breakers, four transformers, six outdoor switchhouses, six 4,500-volt oil circuit breakers, two 66,000-volt lightning arresters, one switchboard, disconnecting switches, etc. The general contract for the remaining work on the initial unit, completed last January, has been let to the Puget Sound Bridge & Dredging Company, Seattle, for $477,538. Advices received in Seattle state that the Allis-Chalmers Company has secured the contract for furnishing four 21,000-hp. and one 2,100-hp. waterwheels for the Rock Island project of the Washington Electric Company, a Stone & Webster subsidiary, the award involving about $700,000. It is stated that awards for between $3,500,000 and $4,000,000 worth of apparatus, including generators, transformers, oil circuit breakers, switchboards, etc., will be let within a few days. Apparatus and motor sales reported include about $6,000 worth of miscellaneous switchgear to central stations in the Seattle district and British Columbia.

CONSTRUCTION PROJECTS

Southern California Edison Company, Los Angeles, Calif., has plans for a power substation at Long Beach, to cost $50,000. Metro-Goldwyn-Mayer, Inc., Culver City, Calif., plans central power plant in connection with expansion and improvement program at motion picture studios to cost $1,000,000. Los Angeles, Manhattan Beach, Fresno, San Jose, Porterville, Gustine and Calexico, Calif., plan ornamental lighting systems. Ekalaka, Mont., plans municipal electric lighting plant. Bozeman, Mont., plans ornamental lighting system. Bureau of Reclamation, Denver, Colo., will receive bids until June 3 for two 42-in. internal differential needle valves for Yakima River Crossing - Wasteway, Yakima Project, Wash. (Specification 511.)

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SOUTHEAST

—FEW INDIVIDUALLY LARGE ORDERS *are reported in the Southeast as a result of the general business situation, but the general volume holds up reasonably well.*

An interesting order reported last week was from a central station in Mississippi for approximately 400,000 lb. of bare and weatherproof copper, while a Georgia company ordered similar material to the extent of $11,200. One company ordered four 2,000-kva., three-phase transformers and $8,830 in distribution transformers, together with $11,500 in creosoted pine poles and line materials; $8,000 in generator repairs were ordered for a North Georgia hydro plant and a North Carolina company purchased one car of "Hitenso" BB wire. Some other power company orders were for $4,800 in hot-dipped galvanized conduit and $4,200 in street car wheels. An electrification contract was signed on a middle South Georgia cotton mill and, besides $11,000 in motors and wiring materials to be purchased by the mill, involves the purchase of a 750-kva. substation and the construction of one mile of high-tension line on the part of the power company. A textile plant in North Carolina ordered $20,000 in loom motors.

CONSTRUCTION PROJECTS

Palmyra Power Company, Erin, Tenn., plans power plant and transmission lines to cost about $100,000. James Supply Company, Chattanooga, Tenn., plans hardware storage and distributing plant to cost $100,000. Covington, Tenn., has approved plans for extensions and improvements in municipal light and power plant. Hazlehurst, Miss., contemplates municipal light and power plant to cost $60,000. Georgia Power Company, Atlanta, Ga., plans transmission line from Statesboro to Brooklet, Ga., and vicinity.

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NEW ENGLAND

—A QUIET TONE PREVAILS *in heavy electrical equipment sales. General scheduled material is in steady demand and motors maintain a steady level in orders. Central-station supplies are spotty. Inquiries show an interest in a wide variety of electrical equipment.*

A number of large motors, including two of over 100 hp., were ordered. Increased activity is noted in the demand for fractional-horsepower motors, with small tool manufacturers, refrigerating equipment manufacturers and others interested. Switch and control equipment orders show little easing up in volume. Transformer orders are spotty. One manufacturer states that service line requirements are steadily including transformers and that the volume of orders for last month shows an encouraging gain over previous months. Outside switch and control equipment orders have fallen off. Insulators are selling well and voltage regulators have been in good demand. Inquiries for arc welding indicate a continuance of interest in this type of equipment and one manufacturer reports several orders pending. Airport enlargement has resulted in an increasing interest in floodlighting and border light installations. One prominent representative estimates roughly that $2,500,000 for electrical equipment will cover additions and new installations to central stations.

Merchandising shows a promising

trend. To date the volume as reported by one group of central stations is about 10 per cent above that of last year.

CONSTRUCTION PROJECTS

Edison Electric Illuminating Company, Boston, Mass., has filed plans for generating plant to cost $200,000, and will build power substation in Concord, to cost $75,000. Lee Electric Company, Lee, Mass., contemplates extensions in transmission lines at Middlefield, Washington, and vicinity. The larger part of contract for steamer *Jacona* has been awarded to General Electric Company, including steam turbines and oil generators. Oil switches are furnished by Allis-Chalmers Company.

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MIDDLE WEST

—GENERAL BUSINESS *in the Middle West section continues to show improvement. While the recovery is admittedly slow, evidence of improvement is noticeable. The major activities, steel, railroad, automotive and electrical industries, are in a more favorable position, while industrial activity is somewhat better.*

—UNCERTAINTY OF THE *copper market has had a decidedly retarding effect on general business. The various utility companies are proceeding conservatively with necessary construction work, although new construction is somewhat slower.*

Some of the interesting orders placed this week include one for 600,000 ft., 477,000-circ.mil and 108,000 ft., 159,000-circ.mil A.C.S.R. cable, addition to present building to cost $600,000, boiler and turbine room instruments to cost $11,000 and several construction orders aggregating $150,000.

Jobbers' sales do not show much improvement this week. While railroad business has been quite substantial, industrial business continues off. There has been a fair demand for most appliances with no outstanding exceptions.

CONSTRUCTION PROJECTS

United States Pressed Steel Company, Ypsilanti, Mich., plans plant at Kalamazoo, Mich., to cost over $175,000. Portland, Mich., will build municipal electric power plant to cost $50,000, and has voted bonds. Michigan Public Service Company, Ludington, Mich., has approved plans for power plant at Leland, Mich., to cost $50,000. Copper District Power Company, Whitehall, Mich., is having plans drawn for hydro-electric power plant near Ontonagon, Mich., to cost $400,000. Chicago & Northwestern Railroad Company, Chicago, Ill., plans freight terminal to cost $3,000,000. Canton, Ill., plans municipal light and power plant extensions, to cost $35,000. Northern States Power Company, Minneapolis, Minn., plans extensions in power plant at Maynard, Minn., to cost $30,000. Mount Pleasant, Iowa, has approved plans for addition to municipal light and power plant.

EASTERN

—MAY ACCOUNT CONTINUES SLOW *in the Eastern electrical equipment market and the majority of manufacturers are recording fewer commitments than at this time last month. While there is an optimistic tone in the situation, no immediate change is in sight. Central-station business is centered in substation and miscellaneous line apparatus and orders are on a noticeably reduced basis. Industrial business is sluggish. Export demand shows betterment and some sizable business is anticipated from that quarter.*

—INQUIRIES FROM POWER COMPANIES *are running light for this time of year and there is not much prospect of improved orders for several weeks to come.*

A central station in Texas has purchased a quantity of transformers from a New York manufacturer totaling $100,000. A hospital in New York has ordered equipment for a power plant, including switchboards, etc., from a New York producer, totaling $125,000.

Export account seems destined for some early sizable commitments. The Soviet Russian Government, Amtorg Trading Corporation, New York, official buying agency, is expected to enter the market soon for railway equipment, including electrical apparatus, and is scheduled to make heavy purchases in the United States and Canada. A German company has secured a contract from the Anglo-Chilean Consolidated Nitrate Corporation, New York, for five Diesel engine-generating units for an installation in Chile, the order totaling about $1,000,000; the same company is in the market for electric cranes and will purchase other operating equipment.

Refrigerating equipment shows higher demand and the majority of manufacturers are running on a capacity schedule, with new high records being developed for shipments. Manufacturers of electric washing machines are also securing satisfactory business, and there has been a good turnover of fractional-horsepower motors for this account by several makers.

CONSTRUCTION PROJECTS

Westchester Lighting Company, Mount Vernon, N. Y., has filed plans for power substation at Pleasantville, to cost $150,000. Kelvinator Sales Corporation, New York, will build electric refrigerator factory branch and distributing plant at Long Island City, to cost $350,000. Long Island Lighting Company, New York, will make extensions and improvements in power plants and transmission lines to cost over $2,000,000. Public Electric & Gas Company, Newark, N. J., has plans for a power substation at Piscataway, N. J., to cost $200,000. Pittsburgh Plate Glass Company, Pittsburgh, Pa., plans addition to sheet glass plant at Crystal City, Mo., to cost $1,000,000. Jones & Laughlin Steel Corporation, Pittsburgh, Pa., will carry out expansion program at plant at Aliquippa, Pa., to cost more than $5,000,000. Chief of Engineers, Washington, D. C., will receive bids until May 16 for four 5-kw. portable generating sets (Circular 25). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until May 16 for air compressor, magnet wire, etc. (Panama Schedule 2554). Board of District Commissioners, Washington, D. C., will receive bids until May 20 for one air compressor.

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SOUTHWEST

—THE STEADY DEMAND *for distribution transformers and meters has held up for the past week. Several good-sized orders have been placed for industrial motors, mostly for textile mills in the South.*

Manufacturers report several big contracts coming on in the next few weeks and that conditions are favorable for a normal volume of business through the summer. Since last week contracts have been signed for three 1,250-kva. transformers to cost $12,000 and induction voltage regulator equipment amounting to $8,000.

CONSTRUCTION PROJECTS

Empire Oil & Gas Company, Bartlesville, Okla., plans pumping plants at Ottawa, Kan., and Wichita, Kan., to cost $200,000 and $100,000, respectively. Ozark Reduction Company, Jasper, Ark., contemplates hydro-electric power plant on Buffalo River, to cost over $150,000. Dallas Power & Light Company, Dallas, Tex., plans extensions in underground and overhead lines in city, to cost $750,000, and will build power substation to cost $100,000. West Texas Utilities Company, Abilene, Tex., will build transmission line from Turkey to Esterline, to cost $150,000, and will make extensions and improvements in power plant at Stratford, Tex., to cost over $100,000. Shreveport, La., plans installation of airport lighting system, in connection with municipal field to cost $100,000.

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Fewer Mining and Industrial Locomotives

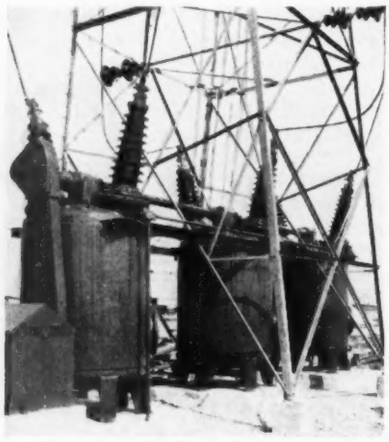
SHIPMENTS OF MINING AND INDUSTRIAL electric locomotives for the quarter ended March 31, 1930, as reported to the Department of Commerce by nine firms, comprising practically the entire industry, were 140 valued at $968,157, as against 214 locomotives valued at $1,251,729 for the quarter ended December 31, 1929, and 207 valued at $1,248,071 for the quarter ended March 31, 1929.

Trolley type mining locomotives outvalued industrial nearly in the ratio of 3 to 1 ($503,837, $182,407).

New Equipment Available

Breaker-Operating Shaft on Roller Bearings

AN OIL CIRCUIT BREAKER of new design, known as type RW-64, 115 kv., 600 amp., is announced by the Pacific Electric Manufacturing Corporation. The tanks are of heavy boiler plate steel, electrically welded into a single unit, with heavy ribs welded on the inside of the top to insure stability of the operating mechanism. The operating



shaft, mounted on the top, is carried on roller bearings, power being transmitted from this shaft to the rotating vertical shaft by means of bronze bevel gears that are also carried on roller bearings. The rotating member that supports the moving contacts consists of a bakelite tube having dielectric strength in excess of the requirements of the A.I.E.E. specifications and mechanical safety factors far above any strain that the control can impose upon the rotating unit, it is claimed.

The type MW-40 control that operates this circuit breaker is equipped with a tripping device that permits very high speed operation of the oil circuit breaker. The main bearings on the motor control are equipped with roller bearings to give greater speed and eliminate friction. The circuit breakers are furnished for voltages from 92,000 to 230,000.

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A MOTOR FOR DOMESTIC applications where quietness is an absolute necessity has been announced by the Baldor Electric Company, St. Louis, Mo. Features of this type CC capacitor motor, it is claimed, are quietness, low cost of operation, no radio interference, low starting current and high power factor for the central station, simplicity of construction, etc. The stator is of the skeleton type.

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Magnetic Reversing Switch

AN INCLOSED, MAGNETIC, reversing switch which is designed to throw small alternating-current motors directly across the line has been announced by the General Electric Company, Schenectady, N. Y. It consists of two triple-pole, mechanically interlocked, magnetically operated contactors with restricted-type blowouts and with a normally open interlock on each contactor. It also has two hand-reset temperature overload relays. The contactors are mounted side by side on a molded base, instead of back to back as in the previous design. The device is contained in a drawn-shell steel-inclosing case. The rating is 110 to 600 volts.

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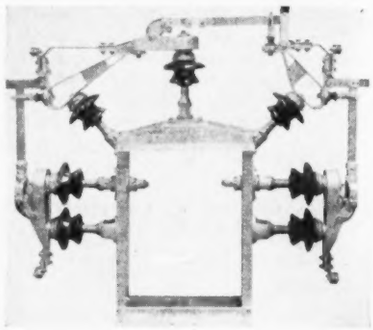
High-Voltage Breakers Deion Grid Equipped

HIGH-VOLTAGE OIL CIRCUIT BREAKERS, type GO, some of them equipped with "Deion grids" and conforming to the new N.E.L.A. voltage ratings, are announced by the Westinghouse Electric & Manufacturing Company. The "Deion grids" reduce the arcing time and the arc energy dissipated in the breaker structure. The arc interruption takes place in arc-extinguishing devices supported from the terminals. These arc-extinguishing devices consist of a series of insulating plates having interspersed plates of magnetic material, all so disposed and vented that the arc is moved laterally into oil pockets, where it vaporizes the oil. The resultant gases are then forced transversely through the conductive gases of the arc stream in such a manner as to deionize them and consequently extinguish the arc in a minimum time with minimum disturbance and with practically no oil deterioration.

The breakers are equipped with condenser bushings, the tanks are made of boiler-plate steel, the breakers are available for indoor or outdoor installations and they are electrically operated with d.-c. solenoid or motor-operated mechanisms.

Vertical Break Switch Reduces Insulators

A NEW VERTICAL BREAK switching unit which, it is claimed, effects a reduction in insulators, in space required and field wiring for outdoor substation



service has been developed by the Delta-Star Electric Company, Chicago, Ill. A three-pole combination consists of three single-pole units. The top switch is for by-passing, the side-mounted disconnects are for the oil circuit breakers. The line and bus conductors connect to the top switch element terminals, the oil circuit breaker leads being connected to the lower terminals of the side-mounted switches. All operating mechanisms are located within the rectangular steel frame and connected to their respective operating handles.

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Full-Bucket Control Automatic Loader

THE ADDITION OF A NEW TYPE of automatic loader for the loading of skip-hoist buckets with coal, coke, ashes, stone, etc., is announced by the Link-Belt Company, Philadelphia, Pa.

The new full-bucket-control loader has a simple attachment, which consists of a swinging plate so arranged that unless material is flowing through the chute in sufficient depth to maintain electrical contact the skip hoist will not operate. In other words, there has to be sufficient material in the hopper to fill the bucket.

When the bucket reaches the loading position the full-bucket-control type loader permits the material to flow from the hopper until the bucket is full, when the mechanism instantly causes it to be hoisted, thereby moving the loader into its closed position, where it remains as the bucket continues to travel to the emptying point and until the bucket returns to the loading position, where it is again automatically loaded.